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Review and Supplement to Stage 2B Selection of Candidate Sites

Environmental Assessment of the Landfill Component of Halton's Solid Waste Management System

October, 1984

URBAN DOCUMENTATION CENTRE
RESEARCH UNIT FOR URBAN STUDIES
McMASTER UNIVERSITY
HAMILTON, ONTARIO

HALTON ENVIRONMENTAL ASSESSMENT
REVIEW AND SUPPLEMENT
TO STAGE 2B
SELECTION OF CANDIDATE SITES

October 1984

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SELECTION OF CANDIDATE SITES

INTRODUCTION

This report has been prepared in accordance with the Stage 2B/2C Supplementary Work Program dated August 28, 1984, which was approved by Regional Council on September 5, 1984.

The Supplementary Work Program incorporates the recommendations of the Region's Energy from Waste Study, which confirm that it will not be feasible to introduce an EFW plant(s) at the beginning of the 20-year planning period for the waste management system as had been anticipated in the Stage 1 Waste Needs and Systems Analysis of the Environmental Assessment for Landfill. In addition, Regional Council resolved on September 5, 1984:

> THAT the landfill capacity for the Environmental Assessment of the Landfill Component of Halton's Solid Waste Management System be Option "C" - "II" set out in Schedule "C" to C.A.O. Report 250/84 being 100% landfill for the first 8 years of the planning period 1988-2008, i.e., to 1996, and 50% landfill/EFW for the remaining 12 years of the planning period to 2008.

Because it was anticipated that the volume of waste to be landfilled would increase as a result of this decision, the total landfill requirement being sought as part of the Landfill Environmental Assessment had to be reviewed.

The supplementary work program for Stage 2B involved a review of the analysis and conclusions in Stage 2B regarding candidate areas and the recommendations regarding candidate sites. This has now been completed.

Section 1 of the report deals with the revised waste forecast for 1988-2008, and provides a new estimate of landfill capacity for the 20 year

planning period. Since an increase in the required landfill capacity is forecast, there is a need to re-evaluate the work in Stage 2B which was based on the original waste forecast of 8.7 million cubic yards. Specifically, the new landfill capacity could affect the size of candidate areas required to accommodate the new tonnage figure. These issues are dealt with in Section 1 and 3.

Section 2 contains a review of the viability of a single site vs. multi-site approach in the waste management system.

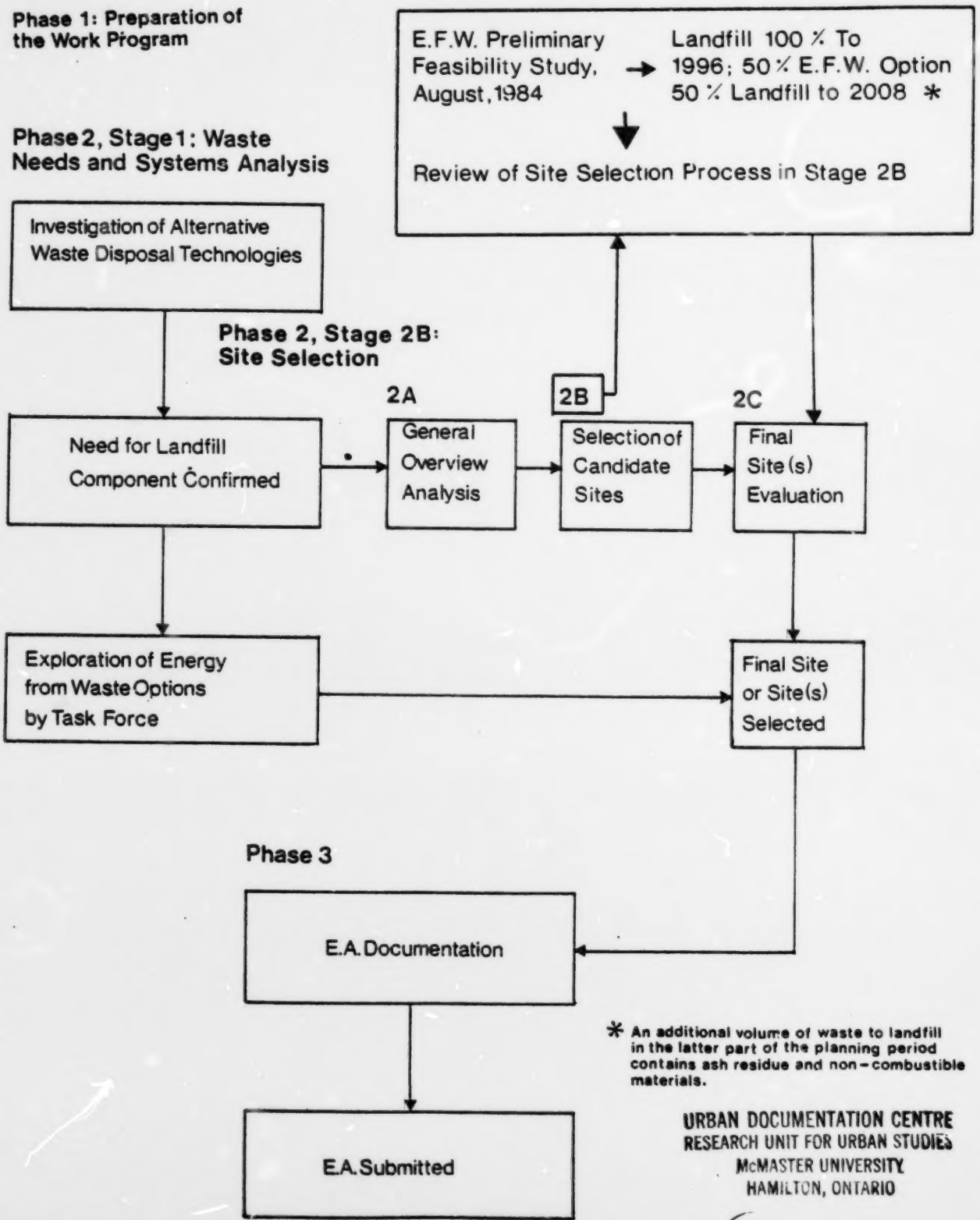
A review of the site selection process in Stage 2B with the changed capacity is included in Section 3. This addresses the evaluation criteria used in Stage 2B to screen candidate areas, and the Stage 2B analysis as it is affected by changes in the landfill capacity.

Finally, Section 4 includes the conclusions and recommendations of the Stage 2B review and outlines the general framework to proceed with the site-specific Stage 2C analysis.

It should be noted that although this report is being written since some of the preliminary work in Stage 2C commenced, such as hydrogeological test drilling of the candidate sites and initial workshops in the communities potentially affected by candidate landfill sites, this review should be read and interpreted within the context of Stage 2B as it was originally completed. Therefore, additional detailed information on the candidate sites from Stage 2C has not been used for the purpose of this review and will be addressed in the subsequent Stage 2C analysis.

HALTON ENVIRONMENTAL ASSESSMENT OF THE LANDFILL COMPONENT

STUDY PROCESS


Phase 1: Preparation of the Work Program
E.F.W. Preliminary Feasibility Study, August, 1984
Landfill 100 % To 1996; 50 % E.F.W. Option 50 % Landfill to 2008 *
Review of Site Selection Process in Stage 2B
Phase 2, Stage 1: Waste Needs and Systems Analysis
Investigation of Alternative Waste Disposal Technologies
Phase 2, Stage 2B: Site Selection
2A
2B
2C
Need for Landfill Component Confirmed
General Overview Analysis
Selection of Candidate Sites
Final Site (s) Evaluation
Exploration of Energy from Waste Options by Task Force
Final Site or Site(s) Selected
Phase 3
E.A. Documentation
E.A. Submitted

* An additional volume of waste to landfill in the latter part of the planning period contains ash residue and non-combustible materials.

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SECTION 1 - REVIEW OF WASTE QUANTITIES FORECAST

1.1 Background

This section outlines the evolutionary process used to develop a waste quantities forecast and the required landfill volume for the Halton Landfill Environmental Assessment, culminating in the production of the waste forecast and required landfill volume to be used in Stage 2C of the project and in the Stage 2B review.

The forecast used in Stage 2B was prepared in February 1983 as part of the Stage 1: Waste Needs and Systems Analysis Report. It was based on a time period from 1982-2001. In October 1983, an initial forecast update was prepared, focussing on the short term (1984-1988) or interim waste period. This report recognized that the long term forecast would ultimately have to be re-examined to: cover the period from June, 1988-2008; provide continuity with the Interim Waste Forecast; and incorporate the effects of some emerging changes in waste volumes which revealed themselves in 1983. In June 1984, the Energy From Waste Preliminary Feasibility Study was published. The analysis was based on a waste quantities forecast for the 20 year period from 1988-2007, developed by extrapolating the projection in the Stage 1 report and incorporating more detailed assumptions concerning ash residue, production capacity, etc.

Sub-section 1.2 of this report highlights the changes which have occurred since the original forecast. Sub-section 3 describes, using flow diagrams, the results of the Stage 1 and Interim Waste forecasts. Sub-section 1.4 outlines trends in Halton's waste quantities, while Sub-section 1.5 describes the updated waste quantities forecast which is to be employed in Stage 2C of the landfill assessment. Sub-section 1.6 converts this waste quantities forecast into the landfill volume requirement, incorporating the effect of the EFW plant, the Interim Waste period update and the required contingency allowances.

1.2 Changes Since the Stage 1 Forecast

° The Need to Consolidate the Interim and Long Term Waste Forecasts

There is a need to ensure that these two forecasts are internally consistent not only with respect to timing but also with regard to the assumptions on which they were based.

° The Forecast Period now Established as June 1988 to June 2008

The Stage 1 forecast was based on the twenty year 1982-2001 forecast period, as it wasn't possible to allow for the implementation of waste management options prior to their selection. The forecast has now been changed to June 1988 to June 2008 and the interim period is now projected to end in May 1988. Within the forecast period, residential, industrial and commercial development is expected to be more extensive in the years after 2001, as compared to the early 1980's, because of the compounding effect of growth during that interval.

The September 5, 1984, Directive from Regional Council that the Landfill Environmental Assessment Assume 100% Landfill for an Eight Year Period and 50% for the Remaining 12 Years

The landfill volume for the Incineration (Energy from Waste) Option in the Stage 1 Report ranged from 5.7 million cu.yd. to 7.2 million cu.yd. The volume calculations were based on the assumption that 25% of the waste would move directly to the landfill and 75% to the EFW plant. (Regional Council directed the Environmental Assessment team to seek a site which would accommodate the 7.2 million cubic yard figure (Council Resolution June 22, 1983)).

Regional Council, as a result of the findings of the E.F.W. Preliminary Feasibility Study, have now directed that the Landfill Environmental Assessment team seek a landfill site which will accommodate 100% of the waste for eight years (June 1988-1996) and 50% of the

waste for a 12 year period (June 1996-2008) during which a EFW plant is assumed to handle the remainder of the waste.

° A Major Reduction in Waste at Halton's Landfill Site in 1983

The Stage 1 report waste forecast was based on Halton population and waste disposal data of the solid waste weighed at Halton landfill sites from 1976 to 1982. A weighed waste figure was applied to the Stage 1 waste forecast. The term "weighed" waste is omitted in this text since the explanation provided here is considered self-explanatory. In 1983, however, there was a major decline in the amount of waste landfilled in the Region. The reasons for this reduction and its implications were discussed in the October 1983 Update Report.

In this document it is now possible to supplement the earlier analyses with data for the first 8 months of 1984, and one of the consequences will be the change in the waste per capita figure which played a major role in the forecast.

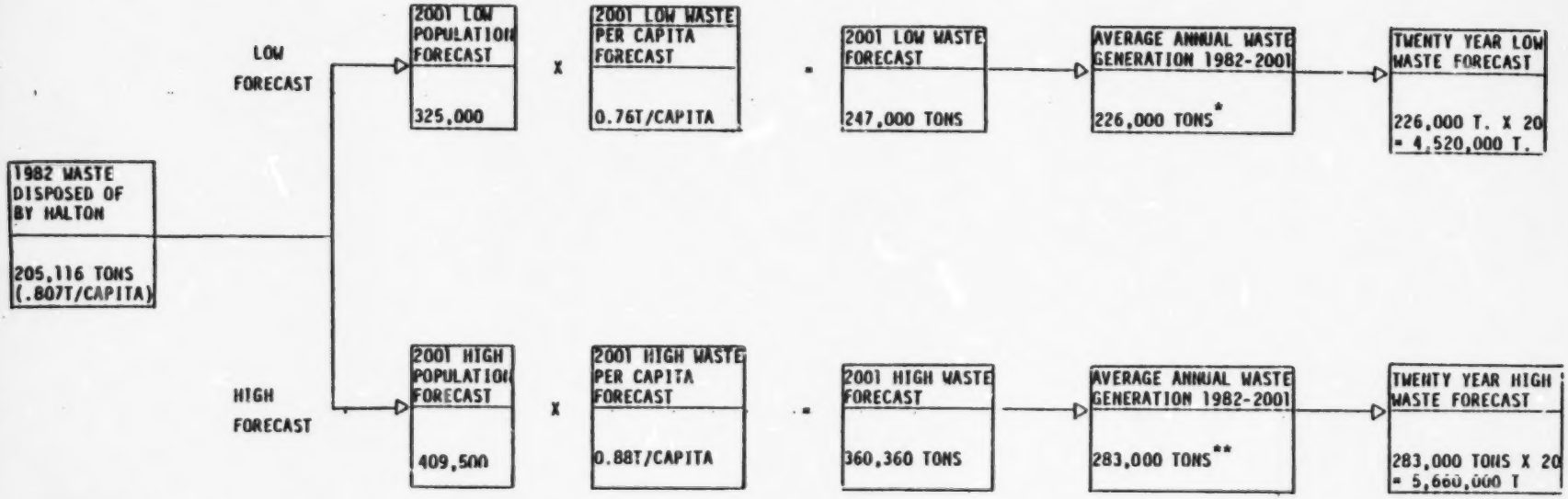
° The Contingency Allowance for the Landfill Space Requirements Included in the Stage 1 Report

The landfill space requirements developed from the waste forecast in the Stage 1 Report (Chart 18) were adjusted to provide contingency for a number of items, including incinerator facility downtime, clean fill, the possibility of unforeseen wastes and an allowance for source separated waste. The basis for more detailed and accurate assumptions in these contingency areas is gradually emerging and updating is therefore possible in this matter as well.

1.3 Previous Forecasts

The results of the two Halton waste forecasts prepared to date are outlined on the following flow charts:

FIGURE 1: STAGE 1 REPORT WASTE QUANTITIES FORECAST (1982-2001)
FOR THE DEVELOPMENT OF LANDFILL SPACE REQUIREMENTS (CHART 18)



DISCUSSION:

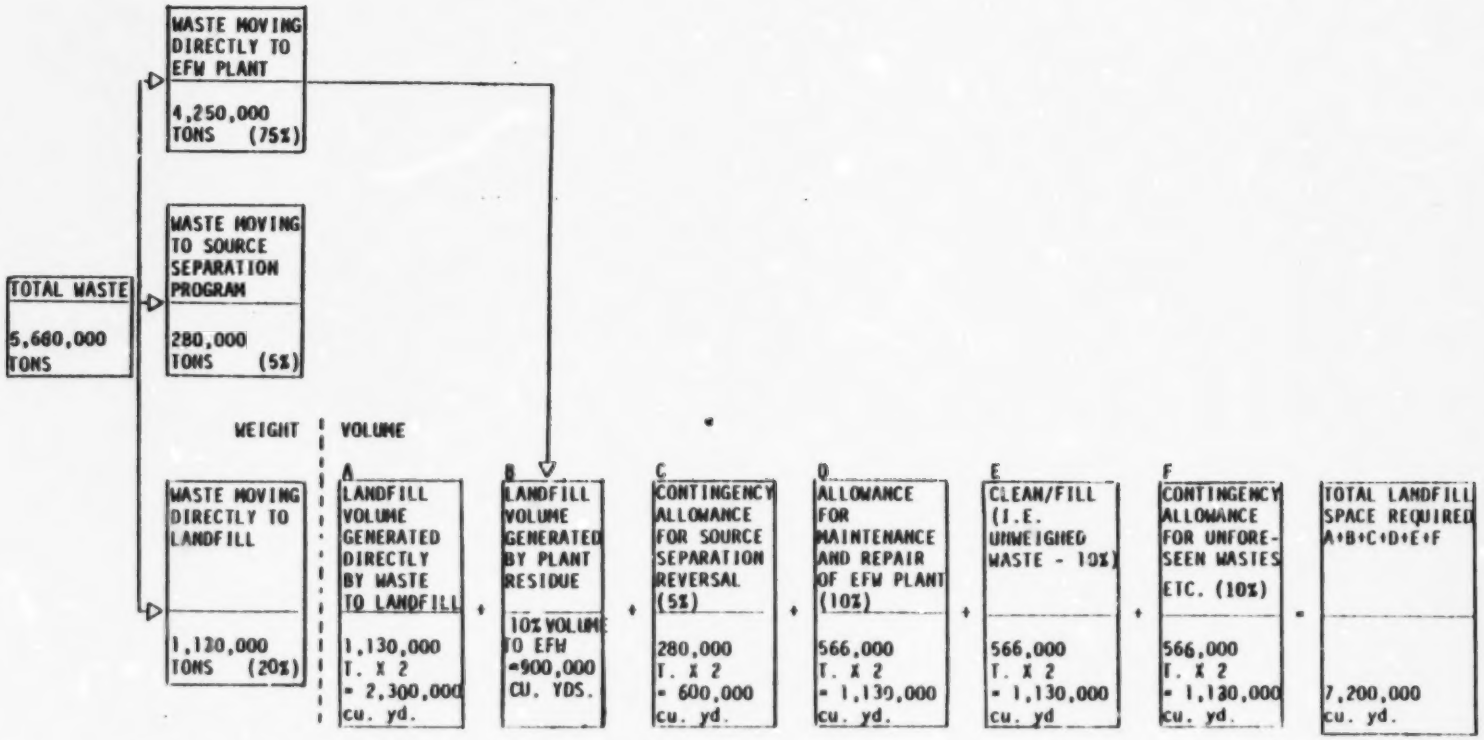
- The actual waste forecast was calculated for five year intervals for the following years: 1986, 1991, 1996, 2001. The population forecast from the Region was only available for those years.

- The waste generation per capita factor had been reasonably stable over the past seven years (1976-1982). For the projection a range of 14% was used between the high and low forecast to accommodate fluctuations in the waste quantities.

*Midpoint between 2001 figure (247,000) and 1982 figure (205,116)

** Midpoint between 2001 figure (360,360) and 1982 figure (205,116)

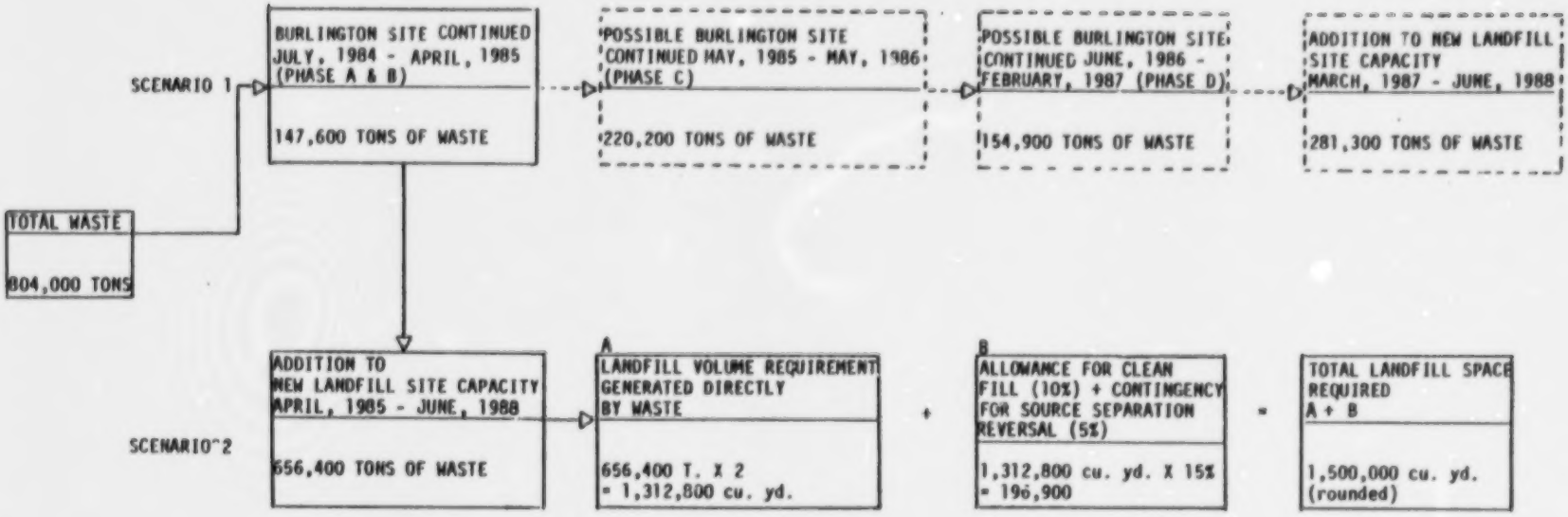
FIGURE 2: STAGE 1 REPORT LANDFILL SPACE REQUIREMENTS (CHART 18)
SYSTEM 1 - INCINERATION (HIGH FORECAST) 1982-2001



DISCUSSION: One ton of waste occupies two cubic yards of landfill space (including required cover material)

Volume figures are rounded.
Box B. is calculated as 4,250,000 tons X 2 X 10% = 900,000 cubic yards (rounded)

FIGURE 3: INTERIM WASTE PERIOD JULY, 1984 - JUNE, 1988


SCENARIO 1
BURLINGTON SITE CONTINUED JULY, 1984 - APRIL, 1985 (PHASE A & B)
147,600 TONS OF WASTE
POSSIBLE BURLINGTON SITE CONTINUED MAY, 1985 - MAY, 1986 (PHASE C)
220,200 TONS OF WASTE
POSSIBLE BURLINGTON SITE CONTINUED JUNE, 1986 - FEBRUARY, 1987 (PHASE D)
154,900 TONS OF WASTE
ADDITION TO NEW LANDFILL SITE CAPACITY MARCH, 1987 - JUNE, 1988
281,300 TONS OF WASTE
TOTAL WASTE
804,000 TONS
SCENARIO 2
ADDITION TO NEW LANDFILL SITE CAPACITY APRIL, 1985 - JUNE, 1988
656,400 TONS OF WASTE
A
LANDFILL VOLUME REQUIREMENT GENERATED DIRECTLY BY WASTE
656,400 T. X 2 = 1,312,800 cu. yd.
+
B
ALLOWANCE FOR CLEAN FILL (10%) + CONTINGENCY FOR SOURCE SEPARATION REVERSAL (5%)
1,312,800 cu. yd. X 15% = 196,900
=
TOTAL LANDFILL SPACE REQUIRED A + B
1,500,000 cu. yd. (rounded)

DISCUSSION:

- One ton of waste occupies two cubic yards of landfill space (including required cover material).
- The contingency allowance is considerably reduced from that of the long term forecast (Figure 2). Since the EFW will not be operating during this period, there is no allowance for facility downtime. In addition, because of the short time period, an allowance for unforeseen wastes was not considered to be necessary.
- Scenario 2 is the Region's preferred option with only the Phase A and B expansion of the Burlington site used. However, this has been reassesed in light of the time required to open a new landfill site as discussed in Section 5. Phase C and Phase D are likely to be required.

Figures 1 and 2: Stage 1 Report waste forecast for the period 1982-2001 with total landfill space requirements calculated in cubic yards.

Figure 3: October, 1983 Update waste forecast for the period 1984-1988 (interim waste period) including separation into the four phases outlined in the Dillon Report, Burlington Landfill Site: Report on Possible Continued Use, October, 1983.

Up until September 5, 1984, the Region had instructed the Environmental Assessment team to locate a landfill site with a maximum capacity of 8.7 million cubic yards (Council Resolutions dated June 22, 1983 and Nov. 9, 1983[1]). This was comprised of 7.2 million cubic yards from the long term waste forecast (Figure 2) and 1.5 million cubic yards from the interim waste forecast (Figure 3).

This formed the basis of the analysis for the Stage 2A and 2B reports. However, the Council Resolution of June 22, 1983, also stated that ". . . before completion of each stage of the Site Selection Procedure and again with the preparation of the Environmental Assessment Document in Phase 3, the Consultant and Staff must review with Council the effects on the process of the size of the landfill component being sought."

1.4 Trends in Halton's Waste Quantities

The quantities of waste landfilled in Halton Region for the years 1982, 1983, and 1984 to date are shown in Table 1. The October, 1983 Update Report forecast that the 1983 waste volume would be significantly lower than the 1982 volume and this, in fact, was the case. Indeed, the Report's 1983 forecast of 185,000 tons was very close to the actual 1983 volume of 184,450 tons as Table 1 shows.

In 1984, waste volumes appear to be returning to more "normal" levels as the Update Report forecast. Over the five-month period between January and

[1]Also letter from C.A.O. dated December 28, 1983.

TABLE 1

TONS OF WASTE DISPOSED OF
AT HALTON REGION SITES
1982, 1983 and 1984 TO DATE

	1982	1983	1984	1984 % CHANGE Based on 1982	1984 % CHANGE Based on 1983
January	12,591	12,314	12,454	- 1.1	+ 1.1
February	15,115	11,328	13,262	-12.3	+17.1
March	15,964	13,831	13,423	-15.9	- 2.9
April	19,283	14,475	17,566	- 8.9	+21.4
May	21,317	20,151	22,447	+ 5.3	+11.4
SUB-TOTAL	84,270	72,099	79,152	- 6.1	+ 9.8
June	20,274	18,400	19,071*	-5.9	+3.6
July	17,127	14,906	17,055*	-0.1	+14.4
August	17,750	17,174	18,287*	+3.0	+ 6.5
September	17,486	16,173			
October	16,426	15,724			
November	17,034	16,650			
December	14,749	13,324			
TOTAL	205,116	184,450	N/A		

SOURCE: Compiled by C.N. Watson & Associates Ltd. from information provided by the Region of Halton.

*Figures for June, July, and August, 1984 became available after the analysis was completed.

May, Halton waste volumes have closed more than half the gap between the 1982 and 1983 figures (84,270 tons vs. 72,099 tons). The volumes for May and August, 1984, exceeded not only the 1983 figures (by 11.4% and 6.5%), but the 1982 figures as well (by 5.3% and 3.0%). In the most recent months, the trend has continued with the increased waste volumes making up almost two-thirds of the reduction between 1982 and 1983.

Table 2 forecasts 1984 Halton waste quantities based on the 1982 and 1983 situations using a similar technique to that in the Update Report. Projections based on recent months' data show a significant range of annual waste quantities (varying by 4,000-17,000 tons approximately), due largely to the decrease in waste quantities which occurred in the early months of 1983. Halton's forecast 1984 annual waste volume would appear to range from 195,000-200,000 tons.

Table 3 shows the tons of waste disposed of at Halton Region landfills by current major disposers for January-May, 1982, 1983 and 1984. The impact of company acquisitions has not been incorporated into this table and is probably a major reason for shifts in waste volume between operators, particularly to Laidlaw and Industrial (see Update Report pages 12-13). The trend for the small haulers listed under the "all other" category is of particular importance. Between 1982 and 1983, the tonnage hauled by these operators fell by 8,700 tons. This accounted for over 70% of the decline in total tonnage (12,171 tons) over the 5 month period. In the 1983 to 1984 period, the volume of waste from these small haulers increased by over 430 tons. The Update Report identifies reasons why the waste volume of small haulers reduced in 1983, including the use of more convenient landfill sites in Peel, Wellington, etc. and lower volumes of waste.

1.4.1 Factors Identified in the October 1983 Update Report as Responsible for the Decline in Halton's Waste Quantities

The Update Report identified four factors contributing to the decline in waste quantities and an estimated tonnage attributable to each. The report

TABLE 2

FORECAST OF TONS OF WASTE TO BE LANDFILLED
IN HALTON REGION DURING 1984
BASED ON JANUARY - MAY DATA

	YEAR TO DATE PERCENTAGES		1984 ANNUAL FORECAST	
	1982	1983	1982 Factors	1983 Factors
January	.06138	.06676	202,900	186,549
February	.13507	.12818	190,390	200,624
March	.21290	.20316	183,837	192,651
April	.30691	.28164	184,761	201,339
May	.41084	.39089	192,659	202,492
June *	.50968	.49064	192,715	200,194
July *	.59318	.57145	194,339	201,729
August *	.67972	.66456	196,500	200,983

SOURCE: Calculated from information in Table 1

*Figures for June, July and August became available after the analysis was completed

**1984 Waste Forecast for January

Based on 1982 factors $\frac{12,591 \text{ tons}}{205,116 \text{ tons}} = .06138$

1984 January waste volume $\frac{12454 \text{ tons}}{.06138} = 202,900$ tons

(1982, 1983 & 1984 monthly totals show on Table 1)

TABLE 3

TONS OF WASTE DISPOSED OF
AT HALTON REGION LANDFILLS
BY CURRENT MAJOR DISPOSERS
FOR JANUARY - MAY, 1982, 1983, 1984

	1982	1983	1984
Burlington Municipal	1,661	735	387
Ford	2,982	1,039	490
Frank	1,108	591	397
J. & J. Haines	803	449	313
General Electric	933	844	911
Greenspoon	N/A	N/A	394
Halton Region and Board of Education	321	133	161
Industrial	6,116	6,405	9,054
Laidlaw	8,080	9,246	12,114
Leaver	1,324	1,235	916
Leferink	3,213	6,438	8,150
Milton	3,150	3,208	3,505
J. Mitchell	529	497	431
Oakville	11,180	10,524	11,733
Provincial (Burlington)	16,942	15,065	15,891
Roy's	2,149	1,248	158
Select	1,730	1,360	318
Syvret	698	489	282
Tricil Ltd.	N/A	N/A	493
Sub-Total	62,919	59,506	66,098
All others	21,351	12,593	13,054
TOTAL	84,270	72,099	79,152

N/A - not applicable

SOURCE: Compiled by C.N. Watson and Associates Ltd. from information supplied by the Region of Halton.

N.B. Table 4 (page 10) in the Update Report lists five additional major disposers in 1983. These disposers are no longer listed in the 1984 records. Some firms may have been bought out. In addition, some of the volume changes are due to acquisitions as noted in the Update Report.

stressed that these tonnages represented informed judgments only, as no specific data was available. This section comments briefly on more recent trends in each of the factors and estimates the waste quantities which may be expected to return in 1984.

Increased Haul Costs and Tipping Fees

The Update Report noted that the closing of the Oakville site at the end of 1982 added significantly to the haul times and costs for haulers from Oakville and Halton Hills. In addition, the Region raised its tipping fee by $1.00 per ton between 1982 and 1983. The situation with regard to haul times and costs has not changed, although there may be some return of tonnage as operators adjust to the situation and there is a greater opportunity to recoup cost increases. In addition, some landfill sites in surrounding areas appear to be enforcing more stringently their regulations prohibiting disposal by non-residents. The Region, however, has increased its tipping fee by approximately $1.80 per ton between 1983 and 1984 which will possibly mitigate against the return tonnage lost.

ESTIMATED 1983 TONNAGE DECLINE - 5,000 TONS
ESTIMATED TONNAGE RETURN IN 1984 - 2,000 TONS

Weather Conditions

The hot, dry summer in 1983 was a factor in reducing Halton's waste volumes, although not a major one. Weather conditions to date in 1984 appear to be more normal.

ESTIMATED 1983 TONNAGE DECLINE - 1,000-2,000 TONS
ESTIMATED TONNAGE RETURN IN 1984 - 2,000 TONS

Recycling

Interest in municipal source separation is continuing to grow in Halton. The total amount of municipally source-separated waste in the Region was 3,948 tons in 1983. To the end of May in 1984, a total of approximately

TABLE 4

UNEMPLOYMENT IN OAKVILLE/MILTON*
JANUARY TO JUNE 1983 and 1984

	1983	1984	% DECLINE
January	9,043	5,328	-41
February	9,001	5,026	-44
March	8,862	4,681	-47
April	8,499	4,461	-48
May	7,611	4,281	-44
June	6,582	4,550	-31

*1982 and 1983 figures for Burlington were included in the Update Report. Comparable figures for 1984 are not available.

SOURCE: Canada Employment Centre, Oakville Office

2,100 tons has been processed. At this rate, a projected annual amount exceeding 5,000 tons would be recovered. The increase in waste removed from the landfill waste stream to source separation would, therefore, be 1,000 tons. The 1983 Update Report concluded that recycling (including municipal source separation and commercial and industrial recycling) accounted for a reduction in waste volume of 8,000 tons (1983). Of this total, 6,000 tons would be due to recycling by industries, the major contributor being Ford (page 16),

ESTIMATED 1983 TONNAGE DECLINE - 8,000 TONS
ESTIMATED TONNAGE RETURN IN 1984 - 0 TONS

Economic Conditions

The economy has improved in the early months of 1984 compared to the same months in 1983. Unemployment was the proxy indicator used in the Update Report for industrial/commercial production (since most other figures are national in scope). Table 4 shows that unemployment in Oakville/Milton (the only available figures) was lower in 1984 relative to the same period in 1983, and the increase in the volume of waste transported by small haulers (Table 3) suggests that there has been some improvement in the economy.

ESTIMATED 1983 TONNAGE DECLINE - 5,000-10,000 TONS
ESTIMATED TONNAGE RETURN IN 1984 - 7,000 TONS

1.4.1 1984 Waste Projection

The Interim Waste Forecast projected a Halton waste volume of 193,000 tons for 1984, premised on an estimated return of the lost tonnage amounting to 4,000 tons, population growth of 5,000 persons and a waste per capita figure of .777 tons. The waste per capita ratio of .777 tons per capita was based on the following analysis as set out in the Update Report:

1983 Estimated Tonnage (Section 1)	+	Returned Tonnage	=	1983 "Normal" Waste Quantity	Waste per Capita (on 254,085 Popl.)
185,000		10,000-15,000		195,000-200,000	0.767 - 0.787 (Average .777)

This analysis assumes no population increase between 1982 and 1983. Therefore, the ratio may be marginally high, if this is not the case.

Based on the changed circumstances noted above, the estimate of the tonnage to be returned in the first year of the 1984 forecast (4,000 tons) is unlikely to be high enough. It now appears that a figure of 11,000 tons may be more likely, based on the following assumptions:

ESTIMATED TONNAGE RETURN IN 1984

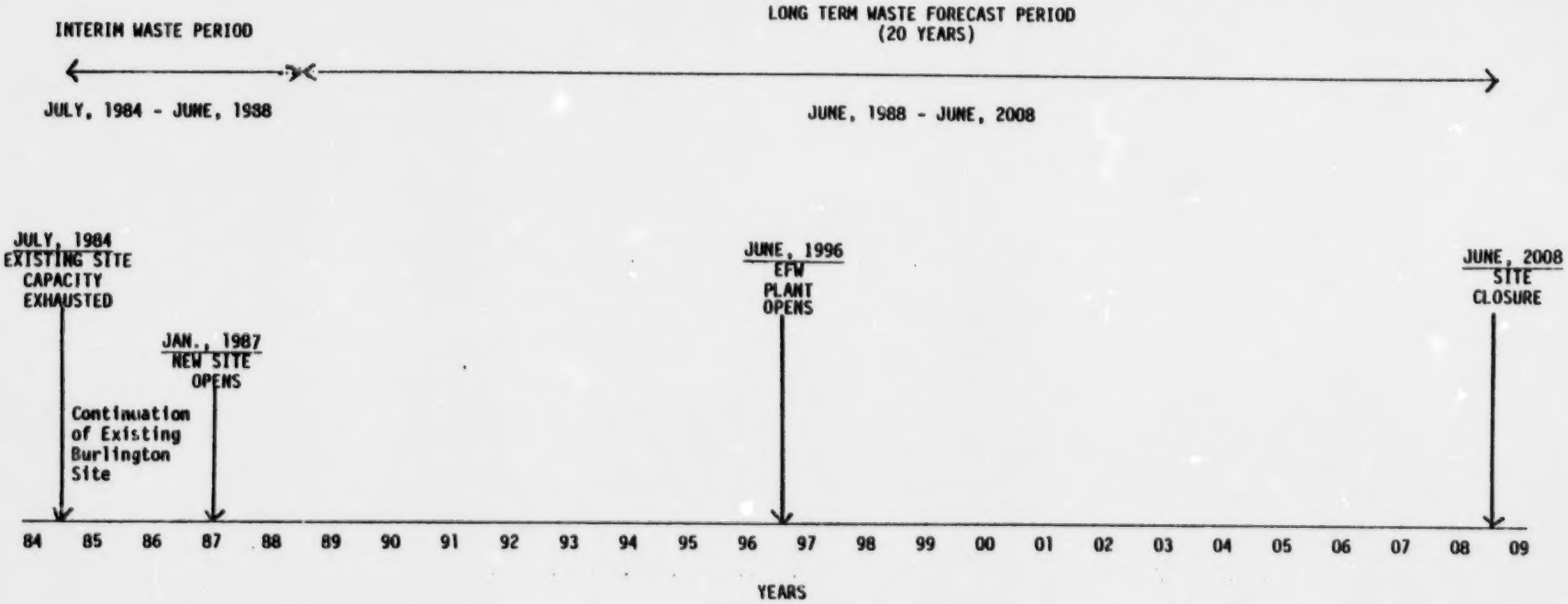
1. Increased Haul Costs and Tipping Fee	2,000
2. Weather Conditions	2,000
3. Recycling	-
4. Economic Conditions	7,000
	11,000 tons

Therefore, the 1984 projected waste volume for Halton is now estimated at 200,000 tons, a 7,000 ton (3.6%) variance from the forecast in the Interim Waste Report.

1.5 STAGE 2C WASTE FORECAST

The development of the revised waste quantities forecast for the Halton landfill requirement is outlined in this section. The timing and the major events in the forecast period are shown on Figure 4. The Region has defined the interim waste forecast period as July 1984 to June 1988 with the long term forecast (20 years) from June 1988 to June 2008.

FIGURE 4: WASTE QUANTITIES FORECAST PERIOD



The Region has recently received Provincial approval for the extension of the existing Burlington landfill site until mid-1987. However, its objective is to commence operations at the new landfill site as soon as possible and to close the existing site. For this analysis, the new site is assumed to open on January 1, 1987, based on consultation with Walker, Wright, Young Associates Limited and Regional Staff (Figure 4). Accordingly, the new site must handle 17 months of 100% of the solid waste generated from the interim waste period (January 1987 - June 1988) in addition to the twenty-year long term waste quantities.

Based on the September 5, 1984, Regional Council Resolution, this forecast assumes that 100% of Regional waste will be landfilled directly during the period from June 1988 to June 1996. In June 1996, an Energy from Waste plant with a capacity to handle 50% of Regional wastes over the period is assumed to commence operations. For the 12 year period between June 1996 and June 2008, the landfill site will be required to handle 50% of the Region's waste quantities (plus ash and residue from the plant).

1.5.1 Approach

In completing the Stage 2C waste forecast, the methodology used in the Stage 1 Report was reviewed and a few revisions were made. A single "most probable" forecast was provided rather than low and high waste quantities projections. With a lower waste quantity, the landfill site(s) would be more than adequate to accommodate the waste. Consequently, there was no need to consider this possibility in the analysis.

However, should a higher waste quantity occur than forecast, a contingency allowance to provide for this has been incorporated into the required landfill volume calculation rather than making a number of separate waste quantity forecasts. This is discussed in Sub-section 1.6.

In addition, this Stage 2C waste forecast shows a specific reduction attributable to municipal source separation.

TABLE 5

SOURCE SEPARATED WASTE IN HALTON (TONS)
1982 and 1983

	NEWSPRINT		GLASS		METAL		TOTAL	
	1982	1983	1982	1983	1982	1983	1982	1983
Burlington	1,428	1,700	300*	190	*	1	1,728	1,891
Oakville	191	1,165	0	250	0	0	191	1,415
Milton	144	54	*	2	*	0	144	56
Halton Hills	548	394	121	98	45	34	714	526
Halton Region Containers	**	60	—	—	—	—	—	60
TOTAL	2,311	3,373	421	540	45	35	2,777	3,948

* Figure includes glass, tin, fine paper and corrugated cardboard from Burlington and Milton.

** Amount is included in municipal figures above.

SOURCE: Halton's Recycled Resources from Halton Region Public Works Department.

1.5.2 Source Separation

Halton's Recycled Resources (H.R.R.), the company handling much of the municipal source separation operation in Halton, has continued to expand its operation in 1983. Residences in Oakville, Milton, and Halton Hills all have curbside pickup for newspapers, glass and tin. The Town of Halton Hills continues to operate its own program for this service ("Divide and Conquer"). Burlington has glass and newspaper pick-up and tin in some cases. The Region continues to operate containers for newspaper at the Burlington Landfill site, the Halton Hills transfer station, and the recently opened container stations in Milton and Oakville. In addition, the Region is evaluating the possibility of taking over co-ordination of the source separation program.

The market for recycled materials is currently excellent and H.R.R. indicate that they could sell much more than they currently process.

Table 5 shows the volume of municipal source separated waste in Halton from all programs in 1982 and 1983. The total increased by 42% (approximately 1,200 tons) between 1982 and 1983. This, in part, reflects an increased level of service with curbside pickup commencing in Oakville in mid-1983. Figures for 1984 to the end of May total 2,100 tons with a projected annual amount exceeding 5,000 tons.

Municipal source separated waste as a percent of landfilled waste is as follows:

TABLE 6: MUNICIPAL SOURCE SEPARATED WASTE AS A PERCENT OF HALTON'S LANDFILLED WASTE STREAM (TONS)

	1982	1983	1984 (projected)
Source Separated Waste	2,777	3,948	5,000
Landfilled Waste Stream	205,116	184,450	200,000
Percent	1.4%	2.1%	2.5%

The Stage 1 Report established a goal of 5% of total waste[2] for the municipal source separation program. However, in the intervening time period, the tonnage of source separated waste and its proportion of landfilled waste have increased significantly. The success of the program would indicate that a higher target may be attainable. Accordingly, the Stage 2C forecast was based on an ultimate goal of 8% of total waste processed by source separation. This would, however, be achieved over time with the percentage increasing by 0.25% a year based on the 1983 figures.

1.5.3 Landfill Volume in the Base Year (1988)

The volume of waste landfilled in Halton in 1983 was 184,450 tons, virtually identical to the Update Report's forecast of 185,000 tons for that year. The Update Report noted that the 1983 volume was exceptionally low due to a number of temporary factors and unusual conditions which were not expected to prevail in future. The report forecast the "normal" 1983 waste quantity to be 10,000-15,000 tons higher (page 20) based on the returned tonnage. The total 1983 waste quantity (landfilled) in a normal year would, therefore, be 195,000-200,000 tons. The mid-point of the range is 197,500 tons.

The base year for the long term waste forecast is 1988. The landfill volume for base year development used in the Stage 2C projection was calculated as follows:

[2]The 5% goal was intended for residential source separation only. Recycling by industrial and commercial enterprises in Halton is occurring and will continue in future. However, no data is available on the quantity of waste involved currently or on the trend.

	Tons
1983 waste volume	197,500
1983-1988 increase - 25,000 pop. x .777 tons per capita	19,425
	216,925

The 1983-1988 increase is based on an annual population increase of 5,000 persons supplied by the Regional Planning Department and the revised waste per capita figure set out in the Update Report.

1.5.4 Long Term Waste Forecast

The most probable long term waste forecast (June 1988 - June 2008) is calculated in Table 7. The forecast was based on a set landfill volume for the base year of development (1988) which remains constant during the period. Added to this is the waste generated by the new population (and new non-residential development) calculated by multiplying the population increase by a waste per capita figure. Population information was supplied by the Regional Planning Department (Appendix A). The notes attached to the table explain the assumptions in some detail. The expected increase in source separated waste is shown as a separate column and deducted from the sub-total. It should be noted that, similar to the Stage 1 Report, certain wastes not currently accepted at the Regional landfill site are not included in the projection (hazardous wastes, sludges, etc.). The most probable quantity of waste generated by Halton over the 20 year (long term) period is 4.965 million tons.

1.5.5 Comparison of New Forecast with Stage 1 Report Forecast

The following table illustrates a comparison of the total Halton long term waste quantity projections (tons) for the two forecasts:

Table 7

Twenty Year Long Term "Most Probable" Waste Forecast for Halton Region
(June,1988-June,2008)

Year	Landfill Volume for Base Year (1988) Development (A)	Population Increase	.777 Tons Post 1988	Cumulated Tons from Population Increase (B)	Subtotal (A)+(B)	Addl. Source Separation Deduction (C)	Total Tons (A)+(B)-(C)
1988					124499		124499
1989	216925	4672	3630	3630	220555	3308	217247
1990	216925	4672	3630	7260	224185	3923	220262
1991	216925	4672	3630	10890	227815	4556	223259
1992	216925	5365	4169	15059	231984	5220	226764
1993	216925	5365	4169	19228	236153	5904	230249
1994	216925	5365	4169	23396	240321	6609	233712
1995	216925	5365	4169	27565	244490	7335	237155
1996	216925	5365	4169	31733	248658	8081	240577
1997	216925	5564	4323	36057	252982	8854	244127
1998	216925	5564	4323	40380	257305	9649	247656
1999	216925	5564	4323	44703	261628	10465	251163
2000	216925	5564	4323	49026	265951	11303	254648
2001	216925	5564	4323	53350	270275	12162	258112
2002	216925	6650	5167	58517	275442	13083	262358
2003	216925	6650	5167	63684	280609	14030	266578
2004	216925	6650	5167	68851	285776	15003	270773
2005	216925	6650	5167	74018	290943	16002	274941
2006	216925	6650	5167	79185	296110	17026	279084
2007	216925	5570	4328	83513	300438	17726	282712
2008	90385	2320	1803	36600	126985	7492	119493
TOTALS		109801	85315		5163103	197733	4965370

Notes:

1. 1988 data was taken from Table 8, page 23, Interim Waste Forecast from the October 1983 Update Report. Data is for a seven month period (June-December). It follows a slightly different pattern than the long term forecast.

2. The source of the base year (1988) waste volume is described in the accompanying text.

3. The population increase for the period 1989-2001 was taken from Table 15 in the Stage 1 Report. The population increase for the period 2001-2008 was taken from the "Initial Regional Test Run" completed for the revised population projection currently under preparation by Regional Planning staff (Appendix A). The Region has confirmed that these projections as the most up-to-date figures available.

4. Population increase figures are the mid-point of the range supplied.

5. The most probable waste volume per capita figure was calculated in the Interim Waste Report and Section 4 as follows:

197500tons/254085population=.777tons per capita

6. Data for 1988 is for a five month period (January-June).

7. The source separation deduction increases annually from a base figure of 2.1% of the landfilled waste in 1983 by .25% per annum to the target of 8%. Since source separated waste is not considered in the base year waste volume, the percentage has been netted from the deduction in each year.

	STAGE 1 REPORT	REVISED FORECAST
Low	4,522,617	
High	5,756,682	
Most Probable (Mid-Point)	5,139,650	4,965,370

Although the two projections cover different twenty year periods (Stage 1 Report 1982-2001 and the Revised Forecast 1988-2008), the "most probable" forecasts are similar (5.140 million tons vs 4.965 million tons). In effect, the higher population growth in the new forecast has been offset by the lower waste per capita figure based on the 1983 information.

1.5.6 Total Waste Quantity Handled by EFW Plant

The Stage 1 Report calculation of landfill space requirements (Chart 18) under the Incineration (EFW) Option 1, was based on an assumption of 75% of the total twenty year waste stream being handled by the EFW plant, with the remainder going directly to the landfill site. The September 5th Regional Council Resolution directed the Landfill Environmental Assessment study team to assume that an EFW handling 50% of the Region's waste for the final twelve years of the planning period would be in place by 1996. The calculation of total waste to be handled by the EFW, and the residue generated, is shown in Table 8. The assumptions concerning plant capacity and start-up date result in the EFW accommodating the following proportion of the total waste stream under the new forecast:

$$\frac{1.576 \text{ million tons}}{4.965 \text{ million tons}} = 32\%$$

This compares with the 75% of original weighed waste handled by the EFW in the Stage 1 Report.

TABLE 8

TOTAL WASTE QUANTITY TO BE HANDLED BY EFW PLANT ASSUMING
8 YEARS OF 100% LANDFILL AND 12 YEARS 50% DIRECT TO LANDFILL
AND 50% TO EFW

Waste to EFW	1,575,991	tons
Residue - Non-Combustible	256,887	tons
- Ash	166,999	tons

Notes and Sources:

(1) Waste to EFW was calculated based on information in Table 7 as follows:

Total Waste Volume	4,965,370	tons
minus June, 1988 - June 1996 Waste	1,813,388	tons
June, 1996 - June 2008 Waste	3,151,982	tons
50% to EFW	1,575,991	tons

(2) Residue - Non-Combustible was calculated at 16.3% of total waste to the plant based on information from the EFW Reports and Regional Staff.

(3) Residue - Ash was calculated at approximately 12.66% of total waste to the plant minus the Non-Combustibles, based on information from the EFW Reports and Regional Staff.

1.5.7 Interim Waste Period

The long term waste projection encompasses the period from June 1988 to June 2008. However, as Figure 4 illustrates, capacity would be available in the new landfill site in January 1987 in the interim waste period. Based on the interim waste projection included in the Update Report, the new landfill site would therefore require capacity to handle an additional 298,466 tons (waste quantity from January 1987 to June 1988).

1.5.8 Total Waste Quantity to be Handled by New Landfill Site

Table 9 combines waste quantities from EFW residue, the interim waste period and the long term forecast waste "direct to landfill" to generate the total waste required to be handled by the new landfill. The total is 4.112 million tons. Of this total, 3.688 million tons of waste would go directly to the landfill site. In addition, there would be 424,000 tons of residue from the EFW plant which must be landfilled. Finally, the need for contingencies will be considered in Section 6.

1.6 Required Landfill Volume

The required landfill volume established during Stage 1 of the study was based on an assumed "in place" density of 1,000 pounds of waste per cubic yard of landfill space. According to Hydrology Consultants,[3] this density conversion factor "is a value commonly used in landfill design today." However, "the figure was arrived at without knowledge of the landfill characteristics . . .. The actual capacity of a municipal sanitary landfill is determined by a) the area of the site, b) its general geologic setting, c) fill height constraints, d) characteristics of the refuse material, e) the compactive effort applied, and f) the rate of filling (slow fill allows settlement to take place)". Hydrology Consultants indicate that "it may be wise to provide a 10% contingency to compensate for less than the predicted density."

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[3]Letter from Hydrology Consultants to C.N. Watson and Associates Ltd., July 31, 1984.

TABLE 9

TOTAL "MOST PROBABLE" WASTE QUANTITY TO BE HANDLED BY NEW LANDFILL SITE
8 YEARS 100% LANDFILL, 12 YEARS 50% DIRECT TO LANDFILL AND 50% TO EFW

	TONS
Total Most Probable Waste Stream	4965370
Less Waste to EFW	1575991
Waste from Interim Period (January, 1987 to June, 1988)	298466
SUB-TOTAL	3687845
Plus Residue - Ash	166999
- Non-Combustibles	256887
TOTAL	4111731

1.6.1 Landfill Volume Requirement to Accommodate the Stage 2C Forecast

Table 10 shows the calculation of landfill space requirements based on the most probable waste quantities forecast outlined in Section 5. The waste volume generated by the waste moving directly to the landfill site over the 20 year period and the residue from the EFW plant totals 8.22 million cubic yards (assuming 1,000 pounds per cubic yard). This figure represents a realistic forecast based on what is known today of the Region of Halton's most likely landfill requirement over the planning period.

However, there is a very real need for contingency allowances to provide for variations which could occur in the forecast assumptions. The planning period is a long one, extending beyond the turn of the century. The level of uncertainty increases as one moves beyond the short-term. As indicated previously, higher actual volumes of waste present a significant risk to the Region as landfill space would run out before the end of the forecast period and the planned-for amortization periods would not be achieved. However, it is possible that future circumstances generating the need for every one of the contingencies will not materialize.

1.6.2 Contingencies Used in the Stage 1 Report

Figure 2 outlines clearly the contingency items employed in determining the long term landfill space requirements in Stage 1 for the Incineration (EFW) option. This analysis was prepared at an early stage in the process when only general information, mainly based on experience in other areas, was available. In setting the contingency levels, the study team concluded that it was advantageous to assume on the high side due to the large number of unknowns (including the possibility of additional types of waste being accepted at the landfill site based on the "Blueprint for Waste" report), the length of the forecast period, and the possible variability in the waste quantities. Subsequent events have confirmed this approach, as the waste quantities varied significantly in 1983 and the EFW capacity is much smaller than that assumed in the Stage 1 calculations. The Stage 1 Report

TABLE 10

LANDFILL VOLUME REQUIREMENTS BASED ON 8 YEARS 100% LANDFILL,
12 YEARS 50% DIRECT TO LANDFILL AND 50% TO EFW

		CUBIC YARDS (millions)
Waste Direct to Landfill	3.688 m.tons X 2	7.38
Residue - Ash	0.167 m.tons X 2	.33
- Non-Combustibles	0.257 m.tons X 2	.51
SUBTOTAL		8.22
Contingency for Waste Projection		
High Population Projection	4.965 m.tons X 9% X 2	.89
High Waste per Capita	4.965 m.tons X 10% X 2	.99
Contingency for EFW Plant		
Downtime	1.152 m.tons X 10% X 2	.23
SUBTOTAL		10.34
Contingency for Volume Requirement		
To cover possibilities such as a lower landfill density, new wastes (ie. clean fill) being accepted at the site, etc.	10.34 m.cu.yd. X 15%	1.55
TOTAL		11.89

SOURCES: Tables 7,8,9

and the new contingency assumptions for Stage 2C and other adjustments to the base landfill volume are summarized in Table 11.

1.6.3 Contingencies for Stage 2C Forecast

Each of the contingency items included in the Stage 1 forecast has now been reviewed in light of the information now available. Some have been retained while others have been combined. The contingencies used in the Stage 2C forecast[4] are discussed below:

° Allowance for High Population Projection

The most probable waste forecast developed in Table 7 was based on an average of the high and low population projections (mid-point) supplied by the Region. The projection period now covers the years 1988-2008. The level of uncertainty in such a projection increases significantly in the later years. To provide for the possibility of higher population growth, a contingency equivalent to the annual average population under the high population scenario relative to the mid-point population used in the forecast has been incorporated. This amounts to 9% of the total waste volume. This contingency was not applied in the Stage 1 forecast since a high waste projection (using the high population forecast) was completed separately.

° Allowance for High Waste Per Capita Projection

Similar to the population projection, the Stage 2C waste forecast was based on a most probable waste generation per capita figure (.777 tons per capita). An actual increase in the waste per capita figure would represent a risk to the Region as more waste would be generated and more landfill space required. The Stage 1 Report (pages 40-44) describes a number of factors which might increase this figure

[4]This analysis has been based on an EFW plant accepting net waste of 1.2 million tons. It is unlikely that precisely this amount would be taken by the plant. No contingency has been included for a lower amount.

TABLE 11

COMPARISON OF ADJUSTMENTS AND CONTINGENCIES ADDED TO STAGE 1 WASTE FORECAST AND STAGE 2C WASTE FORECAST IN DETERMINING LANDFILL CAPACITY REQUIREMENTS

Contingencies	Stage 1 Forecast	Stage 2C Forecast
EFW Facility Downtime	10% of Total Waste (14% of Waste to Plant)	10% of Net Waste to Plant
Source Separation	5% of Total Waste	Included in High Waste per Capita Contingency
Clean Fill	10% of Total Waste	Included in Volume Contingency
Unforeseen Wastes	10% of Total Waste	Included in Volume Requirements and High Waste Per Capita Contingency
High Population Projection	Separate High Waste Forecast Completed	9% of Most Probable Waste Forecast
High Waste Per Capita	Separate High Waste Forecast Completed	10% of Most Probable Waste Forecast
Volume Requirements	Included in Clean Fill and Unforeseen Waste Contingency	15% of Landfill Space Requirements of the above Forecast Items
Other Adjustments		
Residue from EFW - Ash	10% of Waste	12.7% of Net Waste to Plant (included in Table 8)
- Non-Combustible	Included with Ash	16% of Waste to Plant (included in Table 8)

SOURCES: Stage 1 Forecast - Chart 18 and population analysis based on Table 15 in the Stage 1 Report.

Stage 2C Forecast - see discussion in text and Table 8

including: the possibility of unforeseen (non-hazardcus) wastes being accepted at the landfill site; shifts from private to public disposal; changes in the number of jobs per capita in the Region; reversals in the municipal source separation and other recycling programs,[5] etc. The high waste per capita contingency was based on 10% of the total waste volume. This percentage represented somewhat more than the difference between the waste generation per capita figure used in Table 7 and the historical high which the Region has achieved in the past eight years (Table 17 of the Stage 1 Report). This contingency was not applied in the Stage 1 forecast since a high waste projection (using a high waste per capita forecast) was completed separately.

- Allowance for EFW Downtime

A figure equal to 10% of the net waste processed at the EFW plant (minus ash and non-combustible residues) was incorporated into the landfill volume calculation to allow for repair and maintenance of the EFW. A similar percentage allowance was included in Chart 18 in the Stage 1 report.

- Allowance for Volume Requirement

Hydrology Consultants have indicated that there is a need to provide contingency related to the landfill volume requirement to cover such possibilities as a lower landfill density (other than the 1,000 pounds per cubic yard) being achieved, and new wastes such as clean fill and construction debris being accepted at the landfill site, etc. Accordingly, 15% has been added to the landfill volume requirements for a combination of these contingency items. It is calculated on the basis of the total volume requirement of 10.34 million cubic yards.

[5]Note that no separate contingency has been included for this item as in the Stage 1 Report since it is adequately covered by the high waste per capita allowance.

1.6.4 Summary of Stage 2C Landfill Volume Requirement

The landfill volume requirement shown in Table 10 divides into two components:

Region's Most Probable Landfill Requirement	8.22 m.cu.yds.
Contingencies	3.67 m.cu.yds.
	11.89 m.cu.yds.

The contingency items represent an additional 45% of the Region's most probable landfill requirement.

A site which can accommodate the full 12 million cubic yards ideally should be selected, although a smaller site accommodating part of the contingency should not necessarily be eliminated at the Stage 2B level of detail. However, its greater risks in terms of capacity must be acknowledged in the evaluation process in Stage 2C.

1.6.5 Size of Landfill Site Required[6]

The Stage 2B analysis calculated the acreage of landfill site required to accommodate the total volume being sought at that time (8.7 million cubic yards), using a hypothetical model. This approach was necessary due to the larger number and variety of candidate areas being considered at that time. Allowing for a more site-specific evaluation of the six candidate sites and the required landfill size in Stage 2C, the approximate site size based on the new waste forecast is 250-300 acres. The range in the site size depends on site-specific conditions, such as variability of terrain, site shape and existing conditions.

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[6]There is a possibility of some contingency built into the conversion of the landfill volume to the acreage required to accommodate it. To the extent that this is provided, it represents another potential contingency.

SECTION 2 - SINGLE VS. MULTI-SITE SYSTEM ANALYSIS

The terms of reference for the review of the Stage 2B Supplementary Work Program include a re-evaluation of the single site vs. multi-site system analysis in light of two significant changes:

1. The requirement for greater landfill capacity in Halton (approximately 12 million cubic yards vs. 8.7 million cubic yards included in the Stage 2B report)

   On September 5, 1984, Regional Council directed the Landfill E.A. consulting team to seek landfill capacity to handle 100% of the Regional solid wastes for the period June 1988 - June 1996 and 50% of the wastes to the end of the planning period (June 1996 - June 2008). The remaining 50% for the latter period would be handled by an EFW plant. The Stage 2B Report was premised on the EFW plant accommodating 75% of the waste during the entire planning period from 1981-2001. The current update of the waste quantities forecast and required landfill capacity concluded that the most probable waste quantity to be landfilled in Halton (including waste "direct to landfill" from the long term and interim waste periods and the EFW residue) was 4.112 million tons (8.22 million cubic yards). The landfill volume requirement to accommodate this waste is 12 million cubic yards including 3.67 million cubic yards for contingency purposes. The conclusions in Section 1 indicate that in the case of a single site system, a site which can accommodate the full 12 million cubic yards ideally should be selected. Any of the candidate sites which cannot accommodate the total capacity should be assessed in terms of what it can take and the risks in terms of capacity.

2. The requirement that the landfill should accommodate 100% of the Region's wastes for the first eight years and 50% of the wastes (plus plant residue) for the remaining 12 years of the forecast period

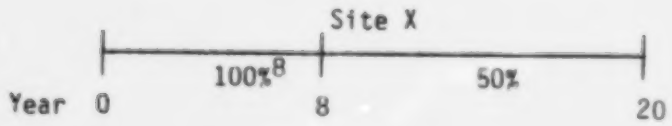
In the Stage 2B report, the assumption was made that the EFW plant would open at the same time as the landfill and accommodate the same percentage of the total waste stream during the forecast period (75%). This was based on the directive of Regional Council approving the 8.7 million cubic yard capacity figure. The decline in waste volume to be handled by the EFW plant under the new Council directive may have some implications in the choice between a single or dual site system in Halton.

2.1 Options

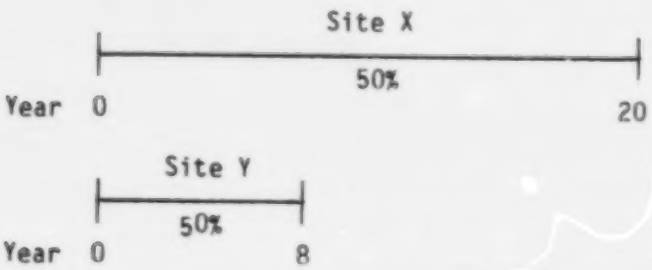
The Stage 2B Report identified three basic options for landfill in Halton over the long term. the first option involves a single site operating during the entire plannng period. A concurrent program could involve two sites[7] operating at the same time for all or part of the period. The third option is a consecutive program whereby one site would be operated for a portion of the period, then closed and a second site for a later portion. Under these options, there are four broad alternatives for the Halton situation. The opening of the EFW plant accommodating 50% of the waste after eight years into the forecast period serves to focus the most feasible options as follows:

- Alternative A - a single site operating throughout the forecast period, with 100% of the waste stream during the initial 8 years, and 50% to landfill in the latter part of the period.

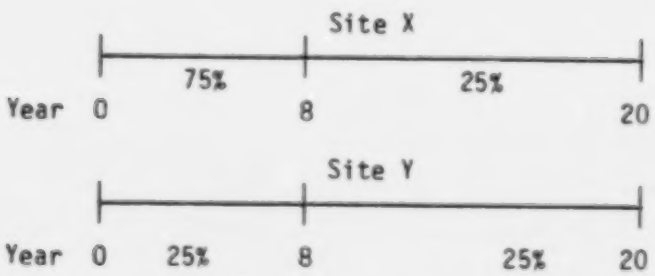
[7]The Stage 2B Report also considered the possibility of three or more sites in a multi-site system. However, this type of system would not appear to have significantly different impacts than the dual-site system. Also, it would involve the operation of sites at close to the minimum feasible size (100 acres). For these reasons, it has not been incorporated into this re-evaluation.



. Alternative B - a concurrent program alternative whereby two sites are operated for the first eight years (when 100% of the wastes are landfilled), one site is then closed, and the remaining site handles the lower waste volume for the latter part of the forecast period.

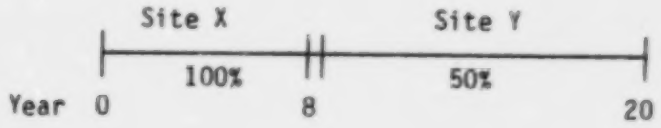


. Alternative C - a concurrent program alternative whereby two sites are operated for the entire forecast period, with one of the sites handling a substantially reduced waste volume once the EFW plant opens in the latter part of the period.



[8]The percentages refer to the percent of Halton's solid waste being handled by the landfill site.

. Alternative D - a consecutive program alternative whereby an initial site handles 100% of the waste; the site is then closed and a second site is opened to handle the lower annual waste volume for the latter part of the forecast period.



2.2 Approach

The evaluation methodology used in the Stage 2B Report considered in a generic way the advantages and disadvantages of a single vs. a consecutive and concurrent multi-site landfilling system. This review will adopt the same general approach and criteria used in the original Stage 2B report. However, the analysis has been supplemented by additional input from the specialist sub-consultants on the Environmental Assessment study team. In addition, to provide some focus for the economic analysis, examples have been cited based on three of the six candidate sites in some cases. The use of the landfill locations is for explanatory purposes only, and does not reflect the more detailed evaluation of the candidate sites in Stage 2C.

In the Stage 2B Report, six general categories for evaluation were defined:

A. Public Health and Safety
B. Natural Environment
C. Social Environment
D. Cultural Environment
E. Costs
F. Engineering & Operations

All of the categories were divided into a number of sub-factors which will be considered below.

The single site option represents the base case for each of the sub-factors because it is considered to be the least complex of the options. The concurrent and consecutive dual site options are evaluated against that standard using the following system:

1. No Effect - dual site operation is not considered to be better or worse than single site system.
2. Positive Effect - dual site operaton would have advantages compared to a single site system.
3. Negative Effect - dual site operation would have disadvantages compared to the single site system.

Consideration will be given to degrees of positive and negative effect although, with a generalized analysis of this sort, these differences are often subtle or non-quantifiable. The process by which conclusions were drawn from this data is explained in the conclusion to this section.

The single site option would handle 100% of the waste stream for the first 8 years, and 50% thereafter. For the purposes of this analysis, it has been assumed that each of the dual site options would handle 50% of the total waste for the period specified.

The 100%/50% breakdown corresponds with alternatives A, B, D and provides a reasonable basis for estimating the impact of Alternative C.

For each sub-factor a brief write-up on the implications of a dual site system relative to a single site system has been included . There are three exceptions to this. The "ground water" sub-factor under Public Health and Safety (A) has not been discussed since any site used would be engineered so as to provide additional assurance of health and safety. In addition, the "renewable mineral resources" sub-factor under Natural Environment (B), and Heritage features and archaeological sites sub-factor under Cultural Environment (C) are very site-specific. In all cases, these were given a neutral (no effect) rating. The overall impact based on the three criteria is summarized on a concluding table.

Category A: Public Health and Safety

Traffic Safety and Service

The development of haulage routes during Stage 2B (Selection of Candidate Sites) was carried out by selecting the most appropriate road links (arterials and highways) for the movement of the trucks between municipal centres (one for each municipality) and the candidate sub-areas. In all cases it was not possible to eliminate the use of local roads in finalizing the routes.

It is along these local road links where the majority of the traffic safety and traffic service impacts are a concern due to the introduction of haulage vehicles and their mix with local traffic. This overview of single vs. dual site transportation aspects concentrates on the likely impacts related to the use of local roads.

Local roads in the Region have varying abilities to adequately handle haulage vehicles due to the range of road/adjacent land use conditions that exist. There are three basic influences on the extent of road upgrading required for these roads if used for haulage:

1. Physical aspects

   - type of road surface (paved surface will be required for trucks)
   - pavement and shoulder widths (generally wider requirement for trucks)
   - general road geometry (trucks can't adequately negotiate steep grades or sharp curves without negatively affecting general road operations/travel speed)
   - intersection conditions (the ability of existing local road intersections to adequately process haulage trucks without negatively affecting other road users may be limited, requiring lane additions or other general improvements)

- general road integrity (road links handling truck traffic must be constructed to ensure proper performance over time; this requires adequate pavement depths, proper drainage facilities - local roads may need reconstruction to provide these basic requirements)

2. Adjacent Land Uses

- the nature of adjacent land uses may require specialized road improvements to negotiate potential traffic conflicts at specific locations
- these are influenced by such factors as the frequency and type of entrances, sensitive land use (schools, churches, recreational uses, natural environment areas, etc.) etc.

3. Truck Volumes

- certain local road upgrading requirements are related to the volume of trucks expected to use the road
- these include traffic signals, control facilities at grade railway crossings, length of auxiliary lanes at intersections, pavement depths, etc.

Essentially, the issue of single versus dual sites in relation to traffic service and safety is how the two scenarios differ in their use of local roads. In general, the use of two landfill sites will require the use of more local roads although with reduced truck traffic in the case of the concurrent sites. However, many of the basic road improvements required to accommodate truck traffic are essentially independent of the truck/traffic volume differences that would exist if one or two sites (concurrent or consecutive) were implemented. In general, improvements would be required to local "haulage" roads in the vicinity of any site due to physical and adjacent land use aspects (as outlined above).

The effect of distributing truck traffic by utilizing two sites will in all likelihood increase the reconstruction requirements to local roads. The use of consecutive sites will reduce the length of time for use of these "improved roads". The use of concurrent sites will reduce the truck traffic volumes on the local roads but it is likely that the impacts to adjacent land uses with respect to traffic service and safety will not reduce significantly and more roads will be impacted.

Category B: Natural Environment

In general, in areas with little previous history of disturbance, increasing the number of landfill locations increases the adverse impact. There would be little difference in the adverse impacts between the concurrent and consecutive dual-site options. However, it could be argued that the consecutive option may produce less overall disruption to wildlife habitat and movement.

In specific instances, factors that must be considered include: (a) the "naturalness" of the site (i.e. farmland vs. forest); (b) the vegetation community type and species competition (i.e. disturbance of two small sites that have common vegetation communities vs. one site with a unique community and/or rare plants); (c) wildlife utilization, for habitat or movement corridors (taking into consideration surrounding habitat utilization); and (d) proximity of the sites to the natural watercourses, and the aquatic communities supported in the watercourse.

Category C: Social Environment

The analysis under Category C: Social Environment impact is intended to provide a general comparison of the single and dual site options in terms of their relative effects on communities and land uses.

The areas of potential impact emanate from the landfill component itself, and include the buffer area, and the surrounding lands. A description of each component is provided below.

i) Fill Area and Buffer Area

The buffer area forms a protective barrier around the fill area. A buffer area of 100 metres was incorporated in the theoretical site size calculation in Stage 2B.

Current land uses and residents would be displaced in the actual fill area. While the fill area and the buffer area may be rehabilitated, site conditions will likely restrict future development.

ii) Additional Area of Impact

This forms the area around the landfill site which may have physical and perceived effects on land use and the community. The extent of this defined for each candidate area in Stage 2B extends one half-mile beyond the candidate area.

There are two major categories of impacts to be considered in the Social analysis:

Permanent impacts are those which will extend beyond the closure of the site. They include:

(a) - impacts on households which have to move off site.
(b) - disruption of residents off site.
(c) - emotional impacts (stigma, stress).

Temporary impacts will occur during the operational period of a site. These include:

(d) - noise.
(e) - airborne particulates and vermin (dust, litter, odour, scavengers).

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Areas of Land Affected

The combined extent of the fill areas on two landfill sites would, in general, be greater than for a single site, to accommodate the same volume of waste. The combined buffer areas and areas of impact for two sites would be significantly greater than for a single site.

(a) Impacts on people/households which have to move off site

While individual site conditions may vary, this sub-criterion is intended to reflect the relative likelihood of people and land uses being displaced. Because the combined fill areas and buffer areas would be greater for two sites than for a single site, the likelihood of displacement would be greater for a dual site option.

(b) Disruption of residents off site

This criterion is considered a permanent impact in that there wll be some residual impact subsequent to closure, however, the greatest impact is likely to occur during site operation. In a dual site system the area affected is greater than for a single site, and therefore the impact in terms of the area and number of people potentially affected is greater. Consecutive operation of two sites would result in reduced impacts at any one time in comparison with a concurrent program.

(c) Emotional Impacts (stigma and stress)

This sub-criterion is intended to include the long term fear of off-site pollution of groundwater which has been expressed by members of the public through the public consultation program. Emotional impacts may be more directly related to site operation, and would therefore be temporary.

(d) Noise

There are two possible sources of noise impact related to landfilling.

- travel noise along the haul routes to the landfill sites.

- operation of the landfill site.

Noise impact is very site specific in that the current level of noise in an area has a major bearing on the impact level. For instance, in areas where there is always a large volume of traffic, the addition of landfill site traffic may not produce a significant impact. In rural areas, where traffic volumes are small, the addition of landfill traffic would have a greater impact.

Truck traffic for each site in the concurrent dual site option would be approximately half the volume for the single operating site thereby lowering truck route sound levels due to the landfill operation marginally. However, with the concurrent operation, the road length affected by landfill traffic would increase significantly. Thus, the impact of lowering the noise levels would probably be more than off-set by the increase in the impact area.

In a consecutive dual site system, the noise impact from landfill traffic would be similar to the single site option, since the volume of waste handled is the same. One additional community would have to acclimatize itself to the noise, however.

The worst case noise impact contours for the operation of the landfill site under the single site scenario would fall at 450 metres and 800 metres for the 55d BA and 50d BA Leq contours when measured from the edge of the operational area of the landfill site. The scheme of using two sites running concurrently but with the same final fill heights as the single site scenario and a 50/50 split in filling activity, will reduce the total area at each site falling within the 55 and 50 dBA Leq contours in half.

The distance from the edge of operations to the 55 and 50 dBA contours will be approximately 315 metres and 560 metres respectively. Thus, a concurrent operation with two sites each impacting half the area of the single site would, in total, have a similar effect to the single site option.

Two sites running consecutively would give little change to the worst case sound level contours. Under the single site option, the sites would be smaller by about 150 metres in each direction, thus the area within the 55 dBA and 50 dBA contours would be smaller in outside radius by this amount.

The noise impact would, of course, occur in two areas rather than one. The consecutive site system would therefore have the same impact, in total, as the single site system under the forecast period.

(e) Airborne Particulates and Vermin

The potential propagation of dust and odour from a landfill site negatively affects the surrounding community.

Since the propagation is, for all practical purposes, radial from the operational portion of a site, the area influenced is approximately twice as large for a dual site option versus a single site option. (The area influenced by a dual option site is not smaller than that influenced by a single option site since the dust and odour are generated at the operational face, not from the entire site). Therefore, the single site option is best (least negative impact), followed by consecutive dual site, and then concurrent dual site (worst case).

Trucks create dust problems along the routes to (and from) a site. Since it is probable that all access roads will be paved, very little dust is generated. Therefore, with regard to dust, the impact of a single versus a dual site option is independent of truck traffic to the site.

The attraction of birds or vermin to a site can and must be controlled through the mitigation measures and operational procedures established at the site. The possibility of problems arising as a result perhaps of faulty operational procedures can be discussed in relationship to the single versus dual option.

A landfill operation will not substantially affect (increase) the bird population in the Region. Birds in the vicinity will be attracted to and congregate at the site. Generally the numbers attracted relates to the size of the operating face. Therefore, the single or consecutive dual options would, in all likelihood, generate the same impact. As part of a concurrent dual option, the negative impacts may be perceived to be greater since there would now be two sites for congregation of birds.

Vermin includes mainly insects and rodents (rats, raccoons) but may also include wild cats and dogs. Unburied or insufficiently buried refuse provides breeding habitat (insects) and a food source (mammals). There would be no difference between a single site option or a consecutive dual site option. However, a concurrent site option would essentially double the possible negative impacts. This categorization would generally hold, regardless of the site(s) chosen.

(f) Land Use

The following describes the potential effects on land use of the single site vs. multi-site system.

Development of the fill area(s) would be essentially "frozen" once the landfill site is in place. In the case of a consecutive progam, land may be designated and approved in advance of the landfill operation, which re-enforces the "freeze" on future development.

Areas which have been landfilled pose several constraints for development such as gas production, low soil/fill bearing capacity and the effects of settling, and the potential effects of leachate. Land uses such as open

space, recreation or agriculture are feasible under completion of the site and during the site operation if rehabilitation is undertaken progressively.

While the buffer area would not be subject to settling, it would be partly affected by landfill and leachate. Installations for the monitoring and control of landfill gas and leachate would be located in portions of the buffer areas.

Current land uses of the buffer area also would likely be displaced as a result of a landfill operation. Environmental constraints imposed by landfill gas and, to a lesser extent, leachate would limit development from occurring in the buffer area during the operation of the site. The buffer area would likely be incorporated into the landfill rehabilitation as an open area; however, it may be possible to have development subject to specific conditions.

Potential impact is greater for a dual site than for a single site system, based on the area of land which would likely be affected.

Permanent land uses in the surrounding area are not necessarily displaced by landfill, but there may be some effects in terms of the rate and type of development which would occur. The area affected would be significantly greater for a dual site than for a single site system. Land use impacts would likely be greater for the concurrent operation of two sites than for a consecutive program. In the case of the area around the second site in a consecutive program, there may be some land use impacts in anticipation of the future operation of a landfill site.

Category D: Cultural Environment

Visual Impacts

The consecutive site system is considered preferable to a single site approach and the latter to be preferable to a concurrent dual site system.

The consecutive site approach is preferred since it would likely require the smallest area of landfill at any given time and visual impact is judged to vary directly with site size. A second site would be required later in the period under this system; howver, it is assumed that the first site would be attractively rehabilitated as a park, agricultural land or the like. It may continue to have an impact in its rehabilitated state, but that impact is considered to be more sociological than visual.

The single site approach is preferable to the concurrent site system, in that the "edge effect" on contour lines surrounding each of the smaller concurrent sites would be reduced by approximately 30%. With each consecutive site having 70% of the impact of the larger single site, the total impact of the two concurrent sites is approximately 40% greater, assuming an equivalent number of spectators are within the contour lines in each case.

From the standpoint of heritage structures, there is a slight preference to the single site approach which would require less acreage to implement

Category E: Costs

The cost impact of utilizing single vs. a dual site landfill system in Halton was analyzed using as examples, cost data for the candidate site locations in Oakville, Milton and Burlington and the revised waste quantities forecast.

The analysis was based on the costs per ton data included in the Stage 2B report under the following categories:

- haul cost
- facility cost
- operating cost
- property value impact
- road construction costs

Haul Costs

The present value of the 20 year haul costs for the representive sites ranged from $21 million to $30 million. A well-located concurrent two site system would reduce haul times resulting in a reduction in haul costs of $1 million to $13 million as compared to one site. The latter saving results largely from the elimination of the transfer station included in the single site system. Haul costs under a consecutive site system would be similar to the single site system unless one of the two sites selected was further from Burlington/Oakville, the major Regional waste generators. With this situation, costs would be significantly higher than for a single site.

Facility Costs

The present value of facility costs under a single site system, using the three sites as examples ranged from $12 million to $14 million. Under the concurrent dual site system, costs are likely to be higher, due to duplication of facilities such as weigh scales, on-site buildings, sewer connection, etc. This could range from $3 to $5 million. A consecutive dual site system would cost more than a single site system due to duplication, with a similar increase of $3 to $5 million for facilities.

Operating Costs

Operating costs under a single site system are estimated to total $26 million based on a present value calculation over a 20 year period. The concurrent dual site system would cost approximately $3.5 million more due to duplication of equipment and manpower as well as increased administrative time. The consecutive dual site system would cost approximately the same as the single site option.

Property Value Impacts and Road Construction Costs

Property value impacts and road construction costs approximate $0.5 million (present value over 20 years) with a single site system. A concurrent dual

site system would cost an additional half million dollars due to the fact that two areas are impacted for a similar period of time. The consecutive dual site system would affect two areas with impact on property values occurring near the unopened site in anticipation of the use. Thus the impact of a consecutive site system would be less favourable than for a single site system.

The cost impact of a single vs. dual site system is summarized as follows:

	Single	Dual-Concurrent	Dual-Consecutive
	$ million	$ million	$ million
Haul Costs	$ 26	$ -6	$ 0
Facility Costs	$ 13	$ +4	$ +4
Operating Costs	$ 26	$ +4	$ 0
Property Value Impact/ Road Reconstruction Costs	$ 0.5	$ +0.5	$ +0.5
	$ 65.5 (100%)	$ +2.5 (+3.8%)	$ +4.5 (+6.9%)

Thus, neither the concurrent nor the consecutive dual site system is preferable from a cost point of view when compared to the single site option.

Category F: Engineering and Operations

Regional Waste Disposal Operations

There are two sub-factors considered under Regional Waste Disposal Operations:

- ease of administration
- provision of back-up facilities

A single site system would be easier to administer by the Region than a concurrent dual site system. It would involve supervision and data collection, record keeping and developing a closure plan for a single site rather than two sites. Staff time and costs would be increased with the concurrent site approach. A consecutive dual-site system would be similar to a single site system from this perspective as there would only be one site to administer at any given time.

A concurrent dual site system would provide back-up facilities not available in either a single site or consecutive dual site system. If a serious problem developed at one of the landfill sites necessitating closure, a second site would be available to handle the waste for a time. However, the use of a second site for emergency back-up would be unpopular with neighbours used to reduced levels of activity.

The number of incidences when this type of back-up would be needed appears to be extremely rare and is not a requirement of the Ministry of the Environment. In addition, there are measures which might be taken to mitigate possible problems in a single site system including backup agreements with neighbouring municipalities. Further, transfer stations and E.F.W. plants can provide storage of waste for a limited period in an emergency.

User Convenience

A convenient landfill system with respect to municipal collection vehicle haul routes, private haulers and residents wishing to dispose of waste, is a desirable objective. It minimizes haulage costs on a Region-wide basis for both public and private users and provides a service directly to citizens, giving them an accessible opportunity to dispose of wastes properly.

A well located concurrent dual site landfill system is better than a single site system from the standpoint of user convenience, as it minimizes haul times, is more accessible to the Regional population and gives the Regional Waste Disposal Operation a greater presence in the Region. This convenience is already reflected to some degree under haul costs in the cost category.

However, the differences in user convenience between a single and concurrent dual site system can be reduced via the use of a highly accessible location and/or the establishment of one or more transfer stations. In addition, container stations such as the Region has recently established in Milton and Oakville provide residents with an accessible disposal location. Thus, transfer stations and/or container station can mitigate any problems associated with user convenience in a single site system.

A consecutive site system would not offer any advantages over a single site system. Well located consecutive landfill sites would offer two different sections of the Region improved user convenience for a portion of the forecast period and lower accessibility in the alternate time. On balance, this would not be an improvement over a well located single site system.

Conclusion

The attached table summarizes the impacts of consecutive and concurrent dual site landfill systems relative to a single site landfill system. The evaluation factors were those set out in the Stage 2B Report, using the

same six categories. A few of the sub-factors shown on page 9 have been combined or eliminated and a few new ones have been added. The same order of priority has also been adopted with respect to categories in the final evaluation of the single vs. dual site issue as that in the Stage 2B Report. Public Health and Safety (A) is of fundamental importance and is ranked first of the four levels of importance. Natural Environment (B) and Social Environment (C) are considered of equal importance and are ranked second. The third category in order of importance is (D) Cultural. The fourth category contains both the Costs (E) and Engineering and Operational (F) factors which are interconnected.

The evaluation of the consecutive dual site option shown on the summary table that:

- eleven of the subfactors rated as having more negative impacts compared to a single site system
- nine of the sub-factors rated as having a similar effect to the single site system
- two sub-factors rated between negative and no impact categories[9]
- one sub-factor rated as having a positive effect when compared to a single site system

Thus, the consecutive dual landfill site system would only be an improvement over the single site system for one sub-factor. Moreover, this sub-factor (Visual) is ranked at the third level of importance and accordingly, receives minor weight in the evaluation process. Thus, a single site system for landfilling would be superior to a consecutive dual site system for Halton, other things being equal.

[9]Sub-factors rated mainly on total area of landfill, which is only slightly larger under the dual site options.

The evaluation of the concurrent dual site option shown on the summary table indicates that:

- fifteen of the sub-factors rated as having more negative impacts compared to a single site system
- three of the sub-factors rated as having a similar impact to the single site system
- two sub-factors rated between negative and no impact categories[9]
- three sub-factors rated as having a positive effect when compared to a single site system

The three sub-factors which would produce advantages compared to the single site option under the concurrent dual site system are haulage costs, user convenience and provision of back-up facilities. All of these are ranked as fourth level of importance and, therefore, each is of minor significance in the overall evaluation process. Therefore, the high number of negative effect ratings in the higher importance categories for the concurrent dual site options far more than offsets the few positive ratings in the least important category. Accordingly, a single site system for landfilling would be superior to a concurrent dual site system for Halton.

In summary, the consecutive or concurrent dual site landfill system has a significant number of potential disadvantages and few potential advantages over the single site system. Provided that the ratings for the individual dual site alternatives are not clearly superior to the ratings for the single site alternatives, it is <u>inevitable</u> that a single site approach would be preferable to a dual site system.

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[9]Sub-factors rated mainly on total area of landfill, which is only slightly larger under the dual site options.

SUMMARY TABLE - REVIEW OF DUAL SITE LANDFILL SYSTEM VS SINGLE SITE SYSTEM

EVALUATION FACTORS	ORDER OF PRIORITY	DUAL SITE OPTIONS						COMMENTS
		Consecutive Sites			Concurrent Sites			
		Negative Effect	No Effect	Positive Effect	Negative Effect	No Effect	Positive Effect	
A. Public Health & Safety	1							
. Groundwater			●			●		Any site used would be engineered so as to provide additional assurance of health & safety.
. Traffic Safety & Road Service		●			●			Road improvements are required independent of volume.
B. Natural Environment	2							
. Agricultural Resources			●			●		Landfill options in two locations would be more disruptive than in one.
. Vegetation		●			●			Increasing number of landfill locations increases adverse impact.
. Wildlife		●			●			Increasing number of landfill locations increases adverse impact.
. Rare & Endangered Species		●			●			Increasing number of landfill locations increases adverse impact.
. Renewable Mineral Resources			●			●		Site specific matter.
C. Social Environment	2							
. Land Use Compatibility		●			●			Dual sites increase acreage required by 10%.
. Household Displacement			●			●		As above.
. Off-site Resident Disruption		●			●			Two sites increase the off-site impact area.
. Emotional Stress		●			●			As above. Consecutive provides anticipatory problems.
. Noise		●			●			No improvement in site noise level with two sites. Truck noise affects larger area.
. Airborne Contaminants (Dust, Odour & Litter)		●			●			Area influenced but two sites twice as large as one site.
. Birds & Vermin			●		●			Two sites operating at same time would double the impact.

SUMMARY TABLE - REVIEW OF DUAL SITE LANDFILL SYSTEM VS SINGLE SITE SYSTEM

EVALUATION FACTORS	ORDER OF PRIORITY	DUAL SITE OPTIONS						COMMENTS
		Consecutive Sites			Concurrent Sites			
		Negative Effect	No Effect	Positive Effect	Negative Effect	No Effect	Positive Effect	
D. Cultural Environment	3							
. Heritage Features & Archaeological Sites			●			●		Area taken almost identical - site specific matter.
. Visual				●	●			Impact reduces with site size.
E. Costs	4							
. Capital		●			●			Infrastructure to be duplicated at second site.
. Operating			●		●			One large site provides economies of scale.
. Property Values		●			●			Two sites increase the impact area.
. Haulage Costs			●				●	Concurrent sites can reduce haul trips.
F. Engineering and Operations	4							
. User Convenience			●				●	Can be enhanced via transfer stations as at present.
. Regional Waste Disposal Options:								
- Administration			●		●			More staff time required for supervision, data analysis.
- Backup			●				●	Back-up not required by MOE.

SECTION 3: REVIEW OF SITE SELECTION PROCESS IN STAGE 2B

The purpose of this section is to review the process in Stage 2B, Selection of Candidate Sites, which resulted in the selection of six candidate sites taking into consideration the increase in the required landfill capacity for the revised planning period 1988-2008.

Previous sections of this report contain a more detailed analysis of the original components of Stage 2B such as the required landfill capacity and the multi-site vs. single site approach. It should be noted that six candidate sites were originally selected partly on the basis of the above-noted factors, but were also selected from a comparison of the candidate areas using environmental, social, cultural and economic factors.

The process at the beginning of Stage 2B identified several dispersed candidate areas in Halton and seven pits or quarries candidate areas for further evaluation and selection of candidate sites.

The intention of the study process was to become progressively more detailed with each new level of analysis. The work in Stage 2B was undertaken for this purpose and to provide the framework for identifying a "manageable number of candidate sites which will fulfill the requirements of the landfill component for the preferred solid waste management system."[10]

Since a broad screening had been undertaken in Stage 2A, General Overview Analysis, more localized information on existing conditions was obtained in the candidate areas from field surveys, air photo interpretation and, in some cases, personal interviews. These additional details were used to

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[10] Walker, Wright, Young Associates Limited, "Work Program, Phase 2, Stage 2B, Selection of Candidate Sites", October, 1983.

the candidate areas and to identify a manageable number of candidate sites for further analysis in Stage 2C.

3.1 Long Term Landfill Capacity

The basis of landfill capacity described in Section 2 of the Stage 2B Report was established much earlier in the Stage 1 Waste Needs and Systems Analysis. In the Stage 1 Report, the system of solid waste management adopted by the Region involved an Energy from Waste facility, landfill, and source separation. The required landfill capacity was a maximum of 7.2 million cubic yards, comprised of approximately 25% of the total weighed waste stream for a twenty year planning period 1981-2001, plus an additional volume for plant residue, plus a contingency volume. The landfill capacity was further increased by 1.5 million cubic yards to a total capacity of 8.7 million cubic yards. It was intended that landfill capacity during the interim period would be accommodated by an expansion of the existing Burlington landfill site and an additional landfill volume at the new site. Approval to expand the Burlington site in four phases was recommended by the Environmental Assessment Board, subject to conditions, on July 26, 1984, and actual approval was given, subject to conditions, on September 21, 1984.

The interim period will remain as originally anticipated. However, the landfill volume to be accommodated by the new Regional waste disposal site during the interim period will be reduced from 1.5 million cubic yards to 298,466 cubic yards. The calculation of the interim waste volume is based on what is now the realistic estimate for the opening of the new site in January 1987, and on the expectation that the Burlington site would continue to provide landfill capacity until early 1987.

The new Stage 2C waste forecast and required landfill volume is described in detail in Section 1 of this report. The results of the waste quantities forecast indicate that a new landfill capacity of 12 million cubic yards is required for the twenty year planning period from 1988-2008, with 100%

landfilling for 8 years; and 50% to an Energy from Waste plant with 50% plus ash residue and non-combustibles to landfill, for the remainder of the planning period.

The current "most probable landfill requirement" in Halton Region is 8.22 million cubic yards from the analysis shown in Section 1 of this report. Contingencies, as described in Section 1, comprise an additional 3.67 million cubic yards. The possible implications of the increase in landfill capacity from the original Stage 2B analysis is considered in the following sections from the Stage 2B perspective.

3.2 Stage 2B Evaluation Criteria

The evaluation criteria used in Stage 2B were established from the six major categories as follows:

- Public Health and Safety
- Natural Environment
- Social Environment
- Cultural Environment
- Costs
- Engineering and Operations

The objectives for siting a landfill site used in the Stage 2B site selection process and the factors and sub-factors for evaluation in Section 3 of the Stage 2B Report were reviewed and are still considered valid. It should be noted that the evaluation factors were applied equally to all candidate sub-areas and, therefore, the increase in landfill capacity should not affect the evaluation and rating of impacts, i.e., "High", "Moderate", "Low".

The only significant difference to the approach in Stage 2B was the cost evaluation of the candidate sub-areas. It was based on single site versus dual site options due to the approach of the Stage 2B cost analysis. Since the candidate sub-areas varied considerably in size ranging from 100 acres to 785 acres, the sub-areas could not be compared equitably on a total cost

basis. A cost per ton figure was used based on each sub-area's capacity for landfilling. The implications of this approach are discussed in a subsequent section.

3.3 Delineation of Candidate Sub-Areas

The methods applied in Stage 2B to narrow down the candidate areas due to specific operating constraints, as described in Section 4 of the Stage 2B Report, are still valid. In addition, the minimum area of 100 acres, other than pits or quarries candidate area, is confirmed based on the need to accommodate approximately 38% additional waste in the landfill site over the twenty year planning period 1988-2008.

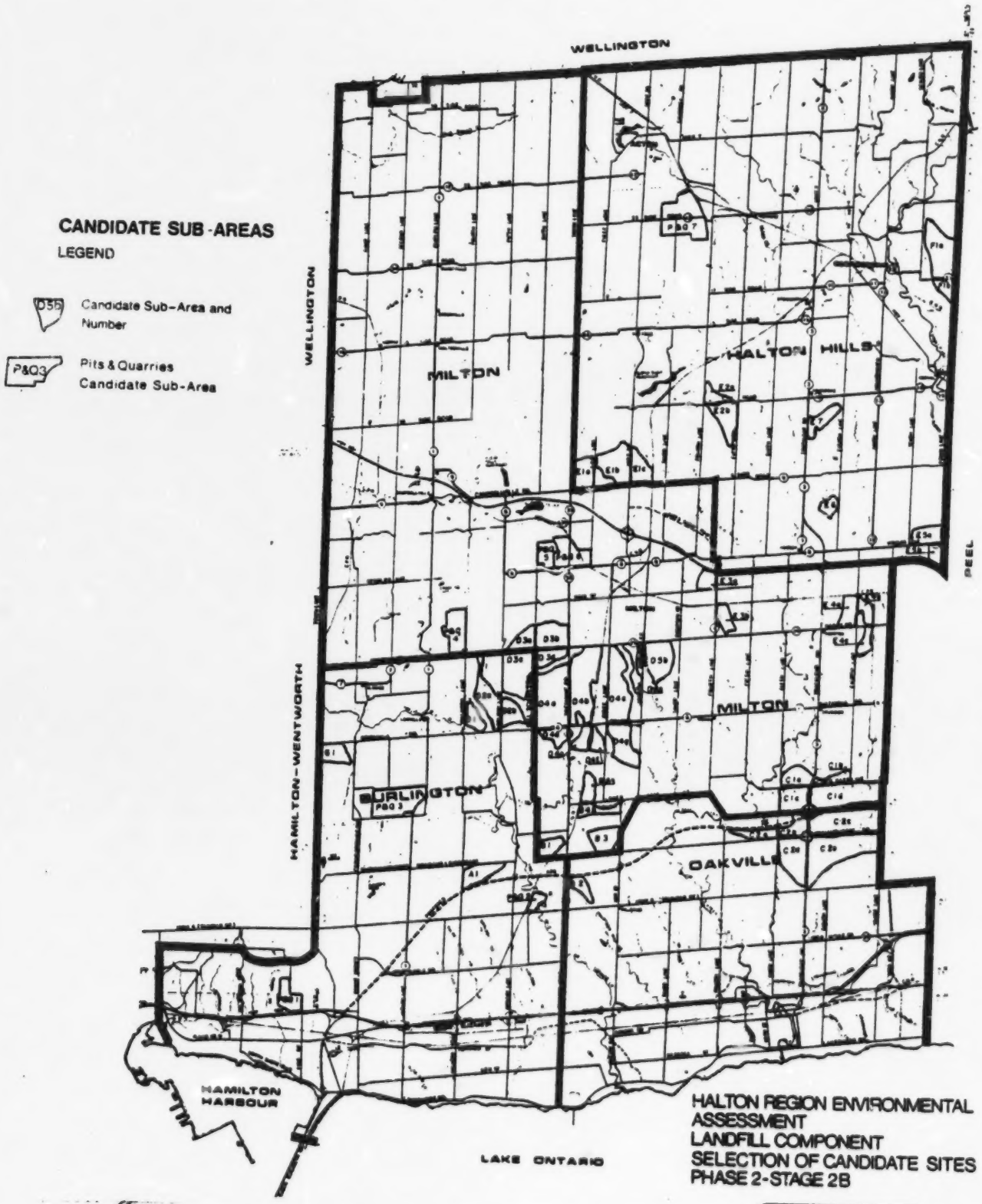
The approximate size of the candidate sub-areas, as shown in Table 1 of the Stage 2B Report, is also confirmed for the Stage 2B review. However, the capacity of the candidate sub-areas was reviewed at the Stage 2B level of detail according to the new landfill volume requirement and the results were incorporated in the economic analysis, where site capacity was a significant factor.

3.4 Stage 2B Analysis

This section deals with the analysis of certain factors undertaken in Stage 2B which reflect consideration of site size and/or site capacity. The following sections from the Stage 2B Report involved some analysis of site size and/or capacity.

Section 5 - Hydrological Analysis and Assessment of Pits and Quarries

With respect to the hydrological analysis of pits and quarries, the factor "Compatibility of Simultaneous Quarrying and Landfilling" was considered. Specifically, the capacity of the seven pits and quarries was expressed in terms of the percentage of the landfill requirement that could be accommodated. The capacity of the pits and quarries has been reviewed using the


CANDIDATE SUB-AREAS
LEGEND
D5b
Candidate Sub-Area and Number
P&Q3
Pits & Quarries Candidate Sub-Area
WELLINGTON
WELLINGTON
HAMILTON-WENTWORTH
PEEL
MILTON
HALTON HILLS
MILTON
BURLINGTON
P&Q 3
OAKVILLE
HAMILTON HARBOUR
LAKE ONTARIO
HALTON REGION ENVIRONMENTAL ASSESSMENT
LANDFILL COMPONENT
SELECTION OF CANDIDATE SITES
PHASE 2-STAGE 2B
Walker Wright Young Associates Limited/Planning Consultants
Halton

new landfill requirement of 8.2 million cubic yards, plus 3.7 million cubic yards for all contingencies.[11] The results are as follows:

- P&Q 1 80%
- P&Q 2 36%
- P&Q 3 100%
- P&Q 4 18%
- P&Q 5 29%
- P&Q 6 29%
- P&Q 7 100%

The above percentages can vary slightly according to modified methods of calculating capacity.

For purposes of Stage 2B the capacity of P&Q 2, P&Q 4, P&Q 5, and P&Q 6 are considered as dual site options in the following economic analysis. The remaining pits and quarries are considered as single site options at the level of the Stage 2B analysis.[11]

Section 11 - Economic Analysis

The economic analysis in Stage 2B was based on the calculation of a total present value cost per ton for each sub-area on the basis of its capacity for landfilling. The sub-areas varied in size substantially (from 100 to 785 acres) and accordingly could not be compared equitably on a total cost basis. The Stage 2B economic analysis was based on three major objectives and eight factors (capital costs, operating costs, haul costs, property value impact, etc.). Costs, however, were ranked as "fourth order of importance" in the evaluation matrix and consequently did not have a major role in the selection of the candidate sites.

[11] A site which accommodates the projected 20 year landfill requirement of 8.2 million cubic yards plus a part of the contingency volume of 3.7 million cubic yards will not necessarily be eliminated. Its disadvantages and risks will be addressed in the detailed Stage 2C evaluation.

The revised waste quantities forecast generally could impact on the Stage 2B analysis with respect to:

- the sites which can accommodate the full landfill waste stream and were thus considered single site options (Table 7);
- the quantity of waste assumed to be handled by the single site options in a dual site system;
- the cost per ton figures for fixed cost components.

The revised waste forecast projects a need for a landfill site(s) in Halton Region over the long term forecast period to ideally accommodate 12 million cubic yards (including contingencies). However, a site which could accommodate the most probable waste projection of 8.2 million cubic yards, for the purpose of the economic analysis, is still considered acceptable as a single site option. Because of the allowance for contingencies and the general basis on which site capacity and costs were evaluated in Stage 2B, this approach is applicable. The figure includes residue from the EFW plant and some waste from the Interim Waste Plan. No additional information is available on the source of waste by municipality. The distribution shown in Table 6 of the Stage 2B report applied to the new landfill waste volume is as follows:

	%
Burlington	41
Oakville	42
Milton	7
Halton Hills	10
	100

It is recognized that the ultimate location of an EFW plant or plants could affect this distribution, but information is not currently available thereon.

The minimum site size required to accommodate the full waste volume of 8.7 million cubic yards in the Stage 2B Report was 229 acres. For the revised figure of 8.3 million cubic yards, the minimum site size is, accordingly, very similar at 221 acres. Based on the Candidate area site sizes included in the Stage 2B Report (Table 1), the 21 single site options would remain. There would be one addition, Candidate Sub-Area B-3. Based on its position in the dual site analysis, the cost rating of B-3 as a single site option would probably be "moderate'. In addition, the cost category was the lowest ranking priority and there were two "high" ratings under Social Environment and Cultural Environment which were more important categories. Consequently, it would not be selected as a candidate site for the Stage 2C analysis.

For the dual site options, which consist of all 55 of the candidate sub-areas, there would be a minor change in the capacity of the sites which are also single site options. The basis on which dual site waste tonnages were assigned to these sub-areas was the total volume from the two closest municipalities (based on travel times supplied by Giffels Associates Ltd.). If the municipalities were Halton Hills and Milton, waste from the third closest municipality was included in order to justify a site of at least 100 acres.

The impact on each cost component of increasing the waste volume is discussed below. Generally, in the case of variable costs, the cost per ton figures would not change except in the few circumstances where acreage formed the basis for the calculation. For fixed costs, there would be some change based on the increase in waste volume allowing for somewhat greater economies of scale. However, in most cases, such changes would affect all candidate sub-areas equally. They were not considered of sufficient significance to justify a complete recalculation of the data. In the discussion below, table numbers from the Stage 2B report for single and dual site options are noted for each cost component.

. Site Capital Costs (Tables 9 and 13)

Capital costs in the Stage 2B Report are a combination of fixed and variable costs. The property acquisition and site development costs were developed in total for each site and then divided by the capacity tonnages. For single site options, the capital cost per ton would be reduced somewhat, but all sub-areas would be affected equally. For dual site options, the cost per ton figure would remain the same (since the sites were already at capacity) except for the 22 now considered as single sites. There would be some cost reduction in these due to their increased waste volumes.

. Site Operating Costs (Tables 10 and 14)

For both single and dual site options, these are variable costs and are not affected by the change in landfill waste volume.

. Haul Costs Including Transfer Stations (Tables 11 and 15)

For the single site options, the cost figures would remain the same with the revised waste quantities.

For the dual site options, there would be some minor changes in the figures due to small shifts in the source municipalities of the waste (i.e., since the waste volume for each municipality has increased but the capacity of these sites has remained the same, the proportion of waste from each source municipality would alter somewhat from that shown on Table 8 of the Stage 1 Report).

. Other Costs (Tables 12 and 16)

For the dual site options, the impact on surrounding property values and the road reconstruction costs would not change except for the 22 single site options. For these, costs per ton would decrease since the total costs are fixed and the waste volume has increased.

Table 16 indicates that these sites tended to have the lower cost figures in any event. For the single site options, costs per ton for these items will decline somewhat, since the total costs are fixed.

In summary, the increased waste volume for landfilling in Halton will not affect the ranking of the single site options Candidate Sub-Area to any significant degree, except for the addition of B3 which would probably receive a moderate ranking under "Costs". The areas of change would affect all single sites proportionately. For the dual site options, there may be some minor shifts in costs per ton and the ranking on Table 19, particularly for the 22 single site options. Also, it is highly unlikely that the ratings for any candidate sub-area would change due to the wide difference (12 points) between the top rated site ranked as low (Q2) and the second site ranked as moderate (A1). In addition, there are four points separating the lowest ranking "moderate" site (B4a) and the highest ranking "high" site (B4b).

Consequently, the sub-area ratings for the economic analysis included in the Stage 2B Report are not altered due to the increase in waste volume.

3.5 Selection of Candidate Sites

The final evaluation of the candidate sub-areas in Section 14 of the Stage 2B Report was undertaken by comparison of the "Severe", "High", "Moderate" and "Low" impact ratings for each candidate sub-area. The order of importance used in assessing the level of impacts was based on the priorities of the six major categories described earlier in the Report.

The criteria for selecting candidate sites was based on the order of importance for each category, the elimination of all "Severe" and "High" impacts; plus the selection of a single site option.

Dual site options, although some may have received a favourable rating, were not considered as potential candidate sites due to the size, capacity, and "High" cost rating, such as Candidate Sub-areas E4a, E4c and E5a.

The preference of the single site option has been confirmed as a result of the Stage 2B review and, specifically, on the current review of a single site vs. dual site option.

The rating of the candidate sub-areas based on other factors in the evaluation matrix Tables 22-25 in the Stage 2B Report do not change as a result of the increase in landfill volume and the selection process, therefore, is not altered from that shown in the Stage 2B Report. Again, in random order, the candidate sub-areas are recommended as candidate sites.

Candidate Sub-Area	Candidate Site
C2c	A
C2d	B
C2e	C
D4g	D
D4a	E
Pit and Quarry	F
No. 1 National Sewer Pipe and Adjacent Property	

SECTION 4: CONCLUSIONS AND RECOMMENDATIONS

On September 5, 1984, Regional Council approved a Supplementary Work Program for Stage 2B/2C. The purpose of the Work Program was two-fold: the first segment was to deal with a review of the Stage 2B Analysis due to an anticipated need for additional landfill capacity under the new waste management system, and the second segment included additional work required in Stage 2C to review the site-specific implications of the new waste management system and anticipated increased waste volume.

The purpose of this report has been only to review the Stage 2B analysis at the level of detail used in that stage of the site selection process. Although some new information on the site-specific aspects of the candidate sites has been obtained since the completion of the original Stage 2B report, such information will not be introduced until Stage 2C. It is the intention of this report to maintain the same level of analysis and the same general approach as in the original Stage 2B.

The review of Stage 2B consists of the following components:

- a review of the long term solid waste quantities forecast and required landfill capacity.

- a review of the Stage 2B evaluation criteria and site selection process.

- A review of the single site vs. multi-site system analysis.

The conclusions from the above-noted review are shown below.

1. The most probable projection of total waste quantities in Halton from 1988-2008 is 4,965,370 tons, compared to the most probable forecast of 5,139,650 tons in the Stage 1 Report. The net decline in the solid waste projection is primarily due to a lower

waste per capita figure of waste generation employed in the current forecast combined with the later time frame in the future and greater population.

2. The percentage of the total waste streams accommodated by the EFW plant(s) is 1,525,991 tons or 32% of the total solid waste stream over the 20 year planning period.

3. The revised landfill capacity requirement for solid waste plus ash residue and non-combustibles totals 8.22 million cubic yards, based on the most probable waste forecast.

4. Additional landfill volume of 3.67 million tons is recommended for contingencies, including an allowance for a high population projection, a high waste per capita projection, EFW downtime, and an additional volume requirement for density and new wastes (clean fill and construction debris).

5. The total landfill capacity, including all contingencies, is 12 million cubic yards. The proportion of the contingency items is 45% of the total solid waste stream.

6. The site size required to accommodate 12 million cubic yards is approximately 250-300 acres. The actual site size of individual candidate sites will be determined in Stage 2C.

7. The Stage 2B evaluation criteria and the selection process are confirmed with respect to the current waste quantities forecast and increase in landfill volume. The six candidate sites are still considered appropriate for further evaluation in Stage 2C.

8. The review of the single site vs. multi-site analysis has confirmed the single site approach as the preferred option.

9. Based on the 2B level of analysis, the candidate sites selected in Stage 2B will accommodate the full volume of waste forecast, i.e. 12 million cubic yards with the exception of Site F which could accommodate approximately 80% of the total waste requirement. The site-specific analysis of all candidate sites will be completed in Stage 2C so that a comparison and ranking of them can occur.

10. Transfer stations should be considered as a potential means of mitigation in conjunction with the single site option in Stage 2C.

APPENDIX A

Region of Halton

Population Forecast Study Update

SUMMARY OF CURRENT AVAILABLE FORECASTS

PERIOD	(1) T.A.L.C.		INITIAL (2) REGION TEST		(3) METRO			LANDFILL (4) 1983	
	HIGH	LOW	HIGH	LOW	HIGH	MED	LOW	HIGH (5)	LOW
	(Population 000[3])								
1986	N.A.	N.A.	284.4	276.2	N.A.	N.A.	N.A.	309.1	269.4
1991	299	265	321.8	297.2	312.3	312.3	310.1	337 ~~377~~	288.3
1996	N.A.	N.A.	362.9	317.2	N.A.	N.A.	N.A.	373.7	305.1
2001	344	282	402.9	338.5	373.2	354	339.3	409.5	325
2006	N.A.	N.A.	441.7	359.3	N.A.	N.A.	N.A.	N.A.	N.A.
2011	N.A.	N.A.	478.9	377.8	445.8	400.3	367.4	N.A.	N.A.

(1) Toronto Area Liaison Committee Alternative Development Scenarios 82 06 30.

(2) Initial Regional Test Runs 83 12 12 High Net Migration Medium Fertility, Low Net Migration Low Fertility,

(3) Metro Toronto Projections Report February 1984 Page 67.1.

(4) Population Forecast Range Submitted to C.N. Watson February 1983.

(5) Regional Plan Forecast adjusted for Acton/Georgetown Urban Area Reviews.

SOURCE: Planning Department Regional Municipality of Halton; May 6, 1984

APPENDIX B

Stage 1: Waste Needs & Systems Analysis

Chart 18

CHART 16

TOTAL LANDFILL SPACE REQUIREMENTS SUMMARY OF PROJECTIONS

System	% of Weighed Waste[1] Direct to "Primary Option"	% of Weighed Waste[1] Source Separated	Landfill Space Requirements in Millions of Cubic Yards[6]					
			Total Volume of Weighed Waste[1] if Landfilled Directly (range)	Volume Weighed Waste[1] Actually Landfilled[2]	(-) Volume Weighed Waste[1] Source Separated[3]	(+) Plant Residue[4]	Contingency (+) Landfill Volume[5]	Total Landfill Space Required
1. Incineration	75	5	9.0 (minimum)	2.3	0.5	0.7	3.2	$5.7 \times 10^6 yd^3$
			11.4 (maximum)	2.9	0.6	0.9	4.0	$7.2 \times 10^6 yd^3$
2. Resource Recovery	75	5	9.0	2.3	0.5	2.2	3.2	$7.2 \times 10^6 yd^3$
			11.4	2.9	0.6	2.8	4.0	$9.1 \times 10^6 yd^3$
3. Export (Hooker)	75	5	9.0	2.3	0.5	2.0	3.2	$7.0 \times 10^6 yd^3$
			11.4	2.9	0.6	2.5	4.0	$8.8 \times 10^6 yd^3$
4. Landfill Only	95	5	9.	9.0	0.5	0	2.3	$10.8 \times 10^6 yd^3$
			11.4	11.4	0.6	0	2.9	$13.7 \times 10^6 yd^3$

[1] Weighed waste is that tonnage which would have been weighed in the Region of Halton sites under the present weighing system. It ranges from 205,000 T/yr. in 1982 to a range of 247,000 to 360,000 T/yr projected for 2001. This gives 20 yr. averages ranging from 226,000 to 283,000 T/yr. which were used in the above table.

[2] This represents the range in landfill volume required for the portion of the weighed waste not fed to incineration or recycling facility (trees, brush, bulky items, etc.).

[3] The landfill volume savings if source separation were practiced.

[4] The landfill volume required for disposal of incinerator or recycling facility residues.

[5] This contingency is based on general waste disposal practice in North America, modified by specific Halton Region conditions. It includes an allowance for possible landfill volume for use during incinerator or recycling facility downtime (10%); the expected volume of clean fill, which is not classed as "waste", but must be provided for (10%); and the difference between the average volumes used and the maximum which may occur, as well as the possibility of presently unforeseen waste being generated and an allowance for waste presently source separated, which was not included in the overall totals (15%).

[6] Landfill space requirements for the 20 year planning period.